"DISEÑO Y APLICACIÓN DE RIEGO POR GRAVEDAD"

RD 1505.1

Informe final

COORDINACIÓN DE RIEGO Y DRENAJE

SUBCOORDINACIÓN DE CONTAMINACIÓN Y DRENAJE AGRÍCOLA

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1. Objetivos

Validar, calibrar y en su caso adaptar y adecuar el sistema computacional para el diseño de riego por gravedad desarrollado durante 2014.

2. Antecedentes

Durante 2014 se desarrolló un software que permite realizar la caracterización hidrodinámica de suelos a partir de los datos de una prueba de avance de riego y de la granulometría del suelo, dicho software también realiza el cálculo del gasto óptimo de riego. A la fecha se hace necesario calibrar y validar el software de tal forma que se encuentre en condiciones de ser transferido a los usuarios potenciales.
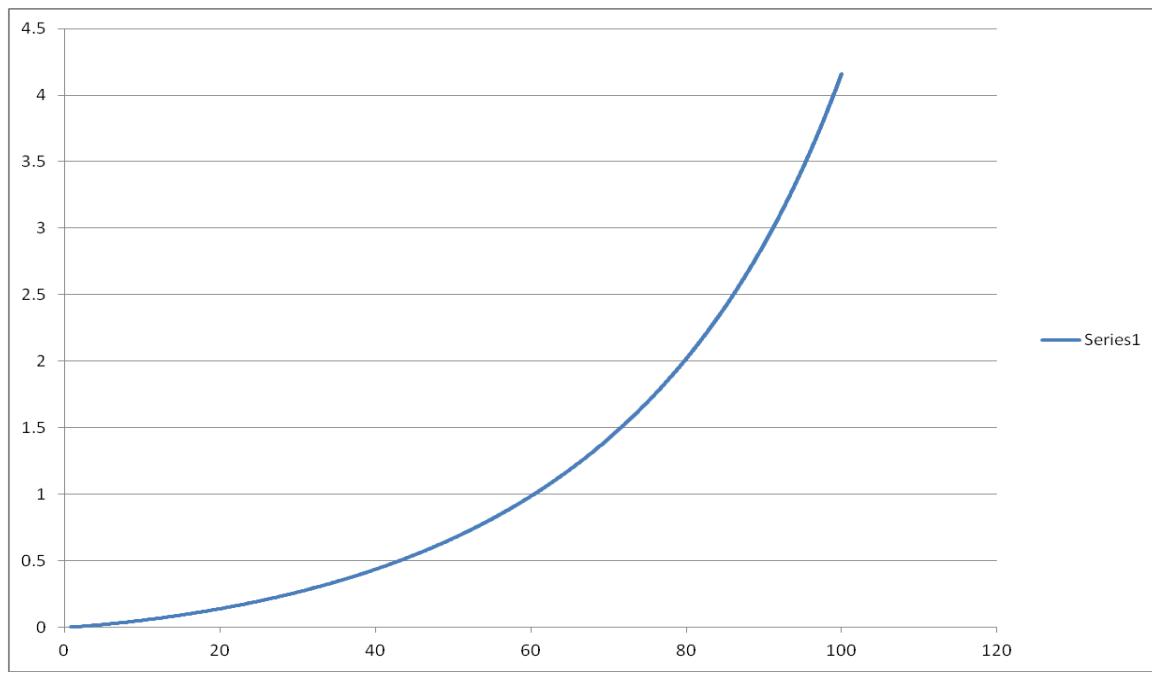
3. Resultados

3.1. Análisis de las variaciones del frente de avance en riego por gravedad en relación con cambios en la conductividad hidráulica a saturación.
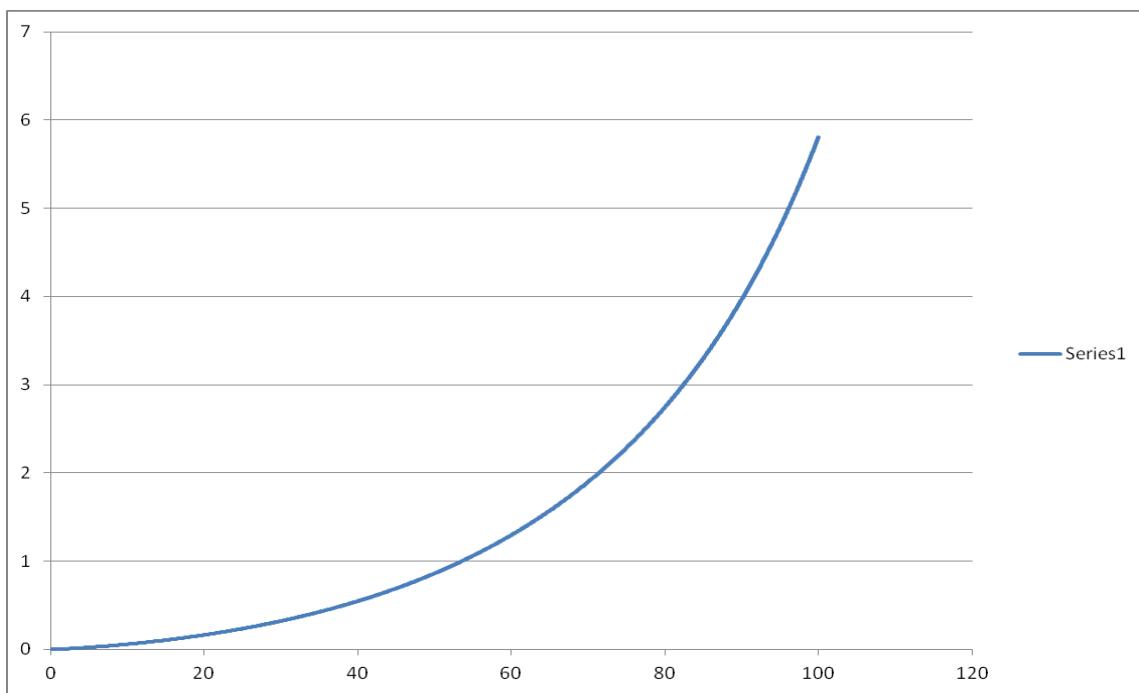
A)   Variación del frente de avance en riego (ks 3.0 hf 10.0)

B)   Variación del frente de avance en riego (ks 3.0 hf 20.0)

C)   Variación del frente de avance en riego (ks 3.0 hf 30.0)

D)   Variación del frente de avance en riego (ks 3.0 hf 40.0)

E)   Variación del frente de avance en riego (ks 3.0 hf 50.0)

F)   Variación del frente de avance en riego (ks 3.0 hf 60.0)
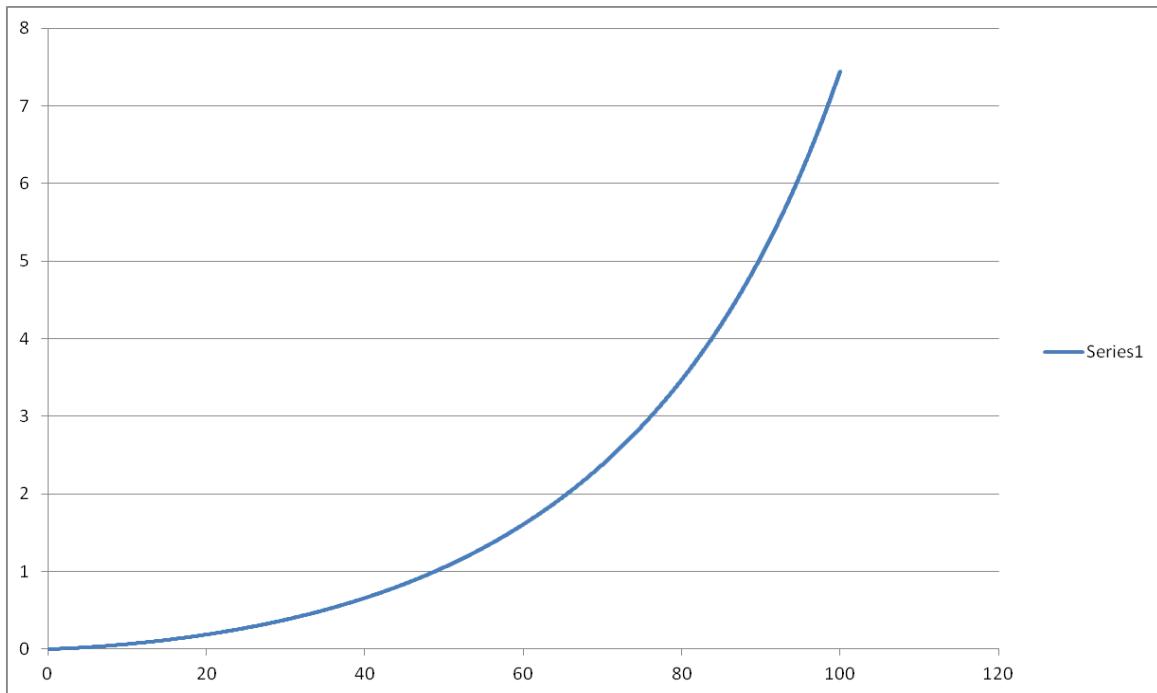
Ilustración 1.- Variación del frente de avance en riego (ks 3.0 hf 10.0).
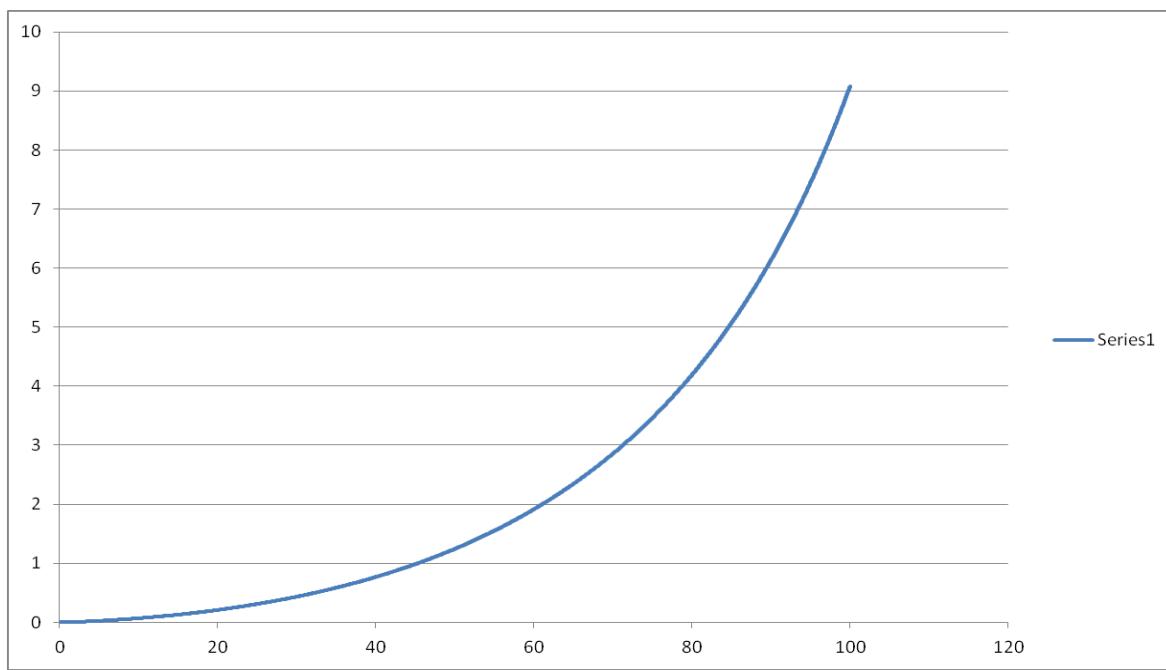
Ilustración 2.- Variación del frente de avance en riego (ks 3.0 hf 20.0).
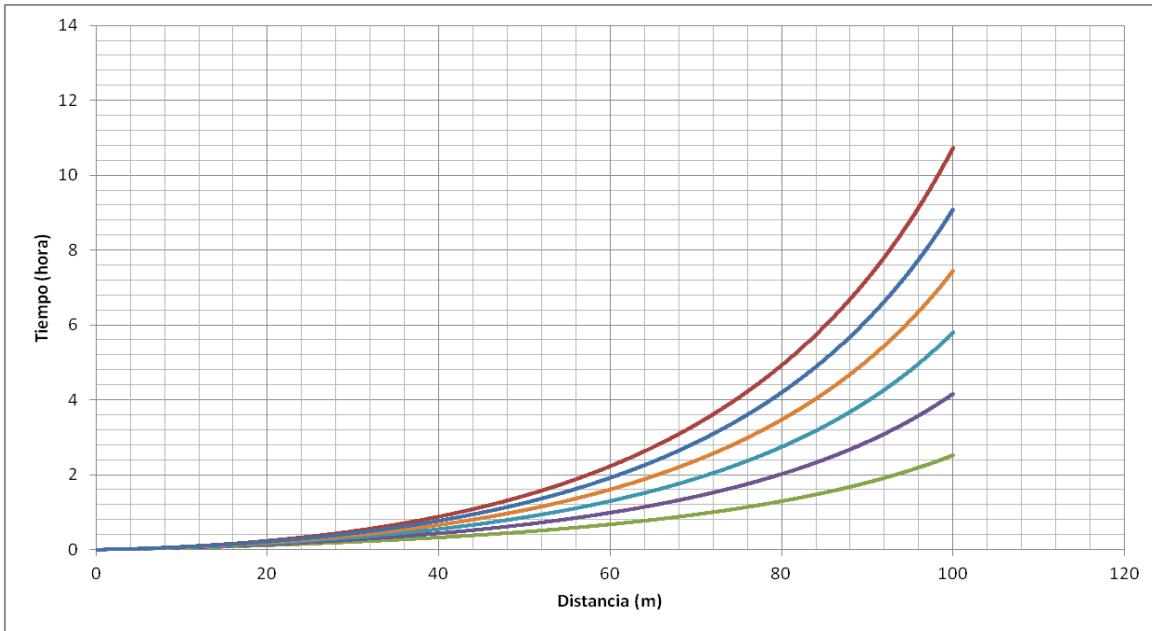
Ilustración 3.- Variación del frente de avance en riego (ks 3.0 hf 30.0).

Ilustración 4.- Variación del frente de avance en riego (ks 3.0 hf 40.0).
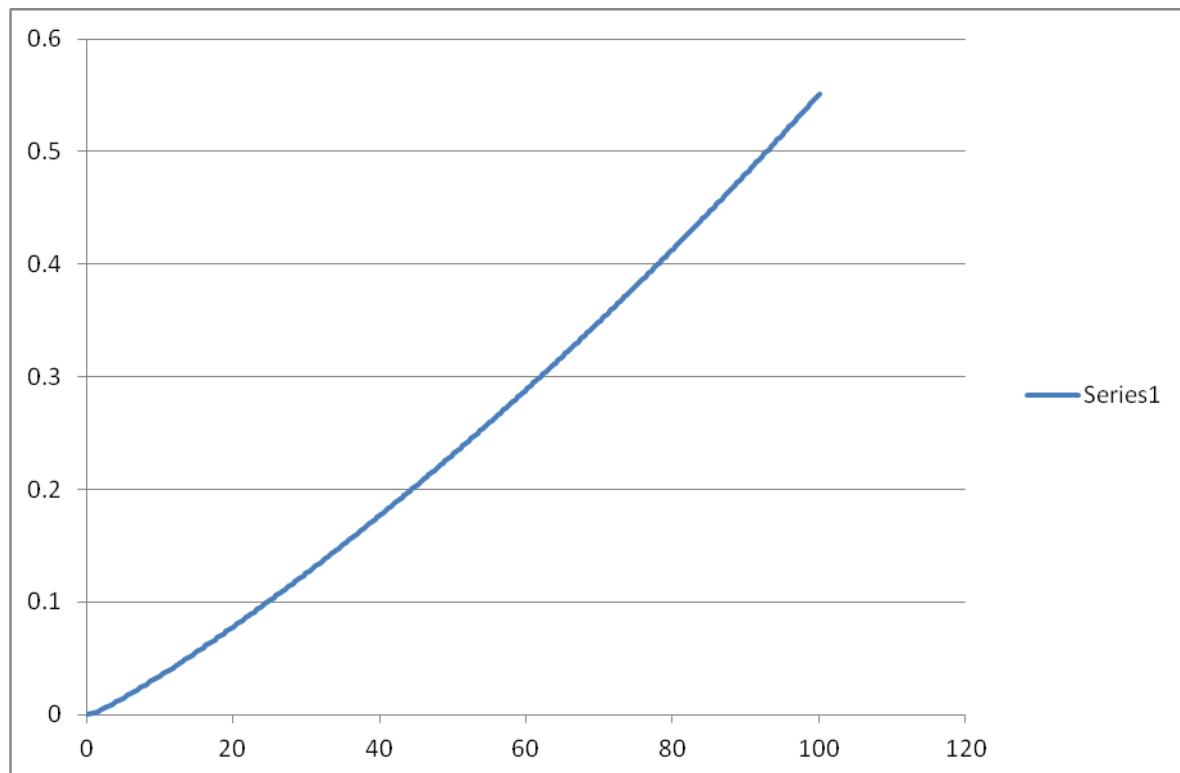
Ilustración 5.- Variación del frente de avance en riego (ks 3.0 hf 50.0).
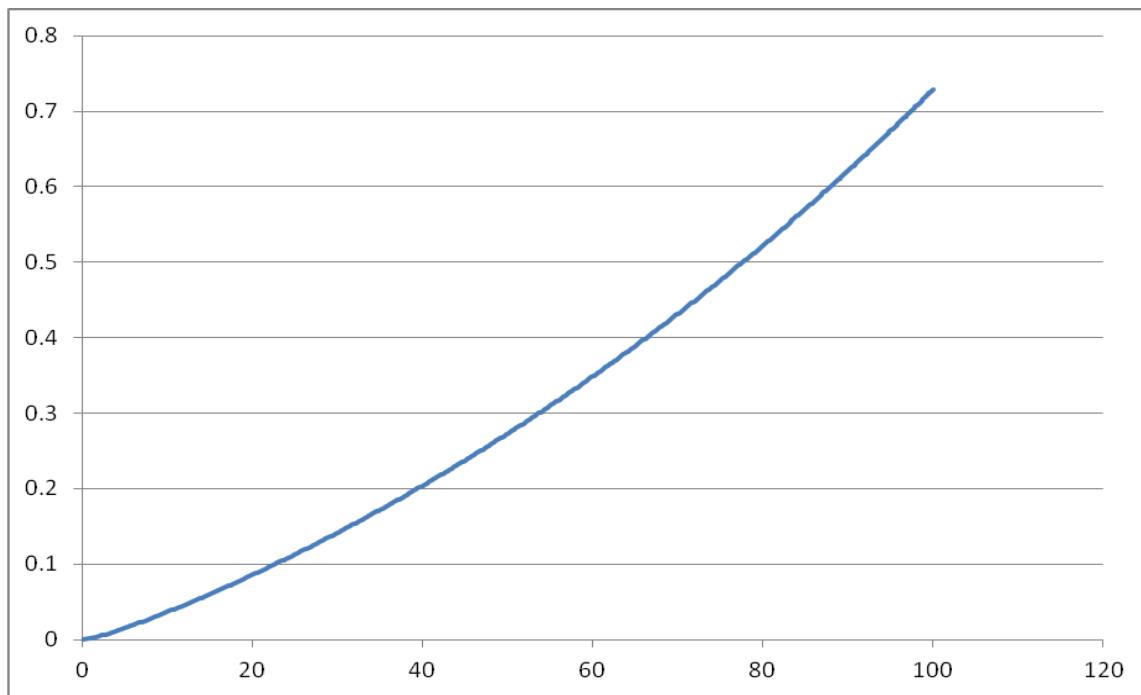
Ilustración 6.- Variaciones del frente de avance en riego (ks 3.0 hf 60.0)

3.2. Análisis del efecto del cambio en la escala de presiones de la ecuación de Green y Ampt sobre la posición del frente de avance en riego por gravedad.
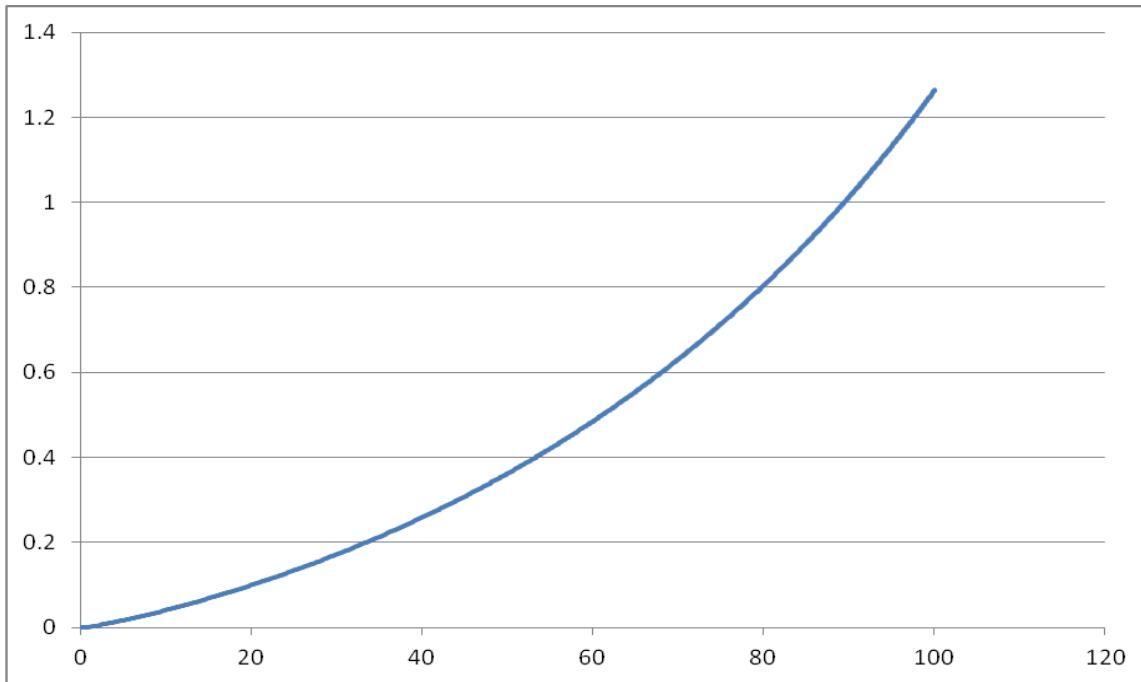
A)   hf 10 ks 0.5

B)   hf 10 ks 1.0

C)   hf 10 ks 2.0

D)   hf 10 ks 3.0

E)   hf 10 ks 4.0

F)   hf 10 ks 4.25
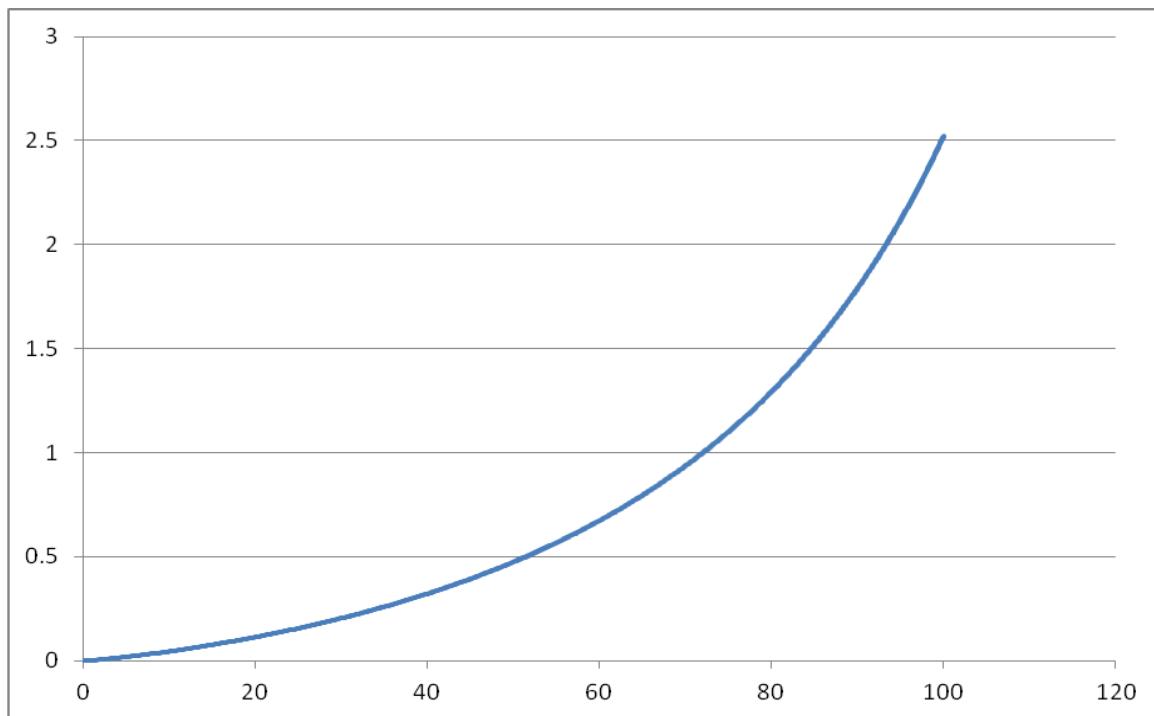
Ilustración 7.- hf 10 ks 0.5
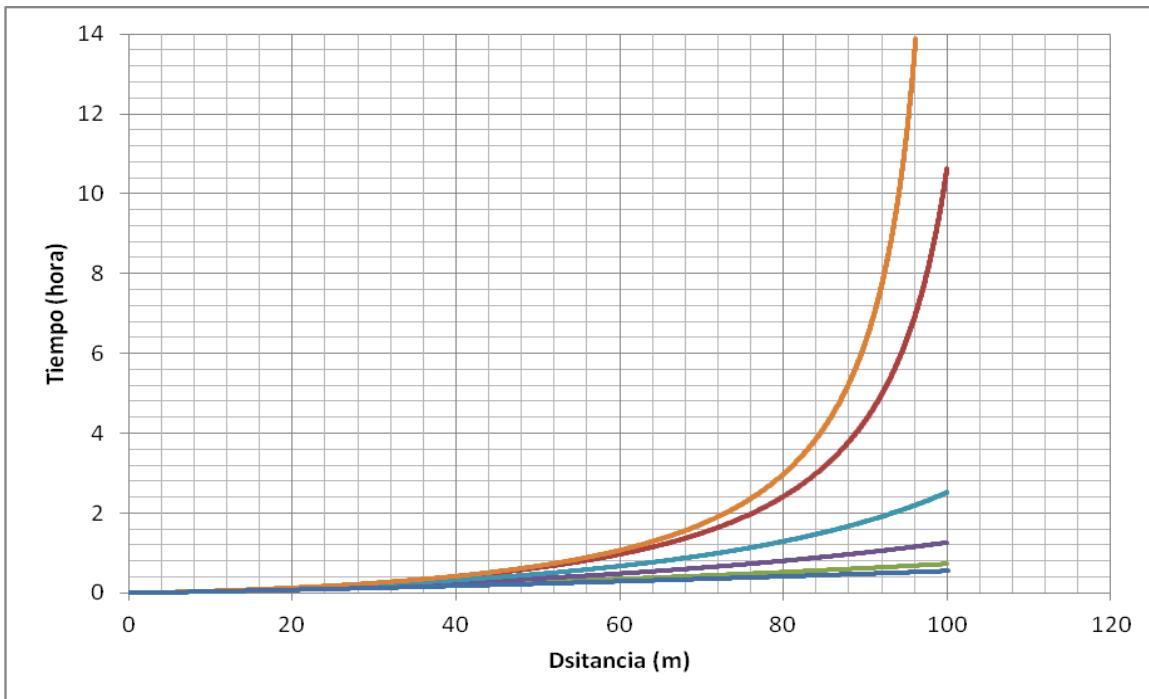
Ilustración 8.- hf 10 ks 1.0
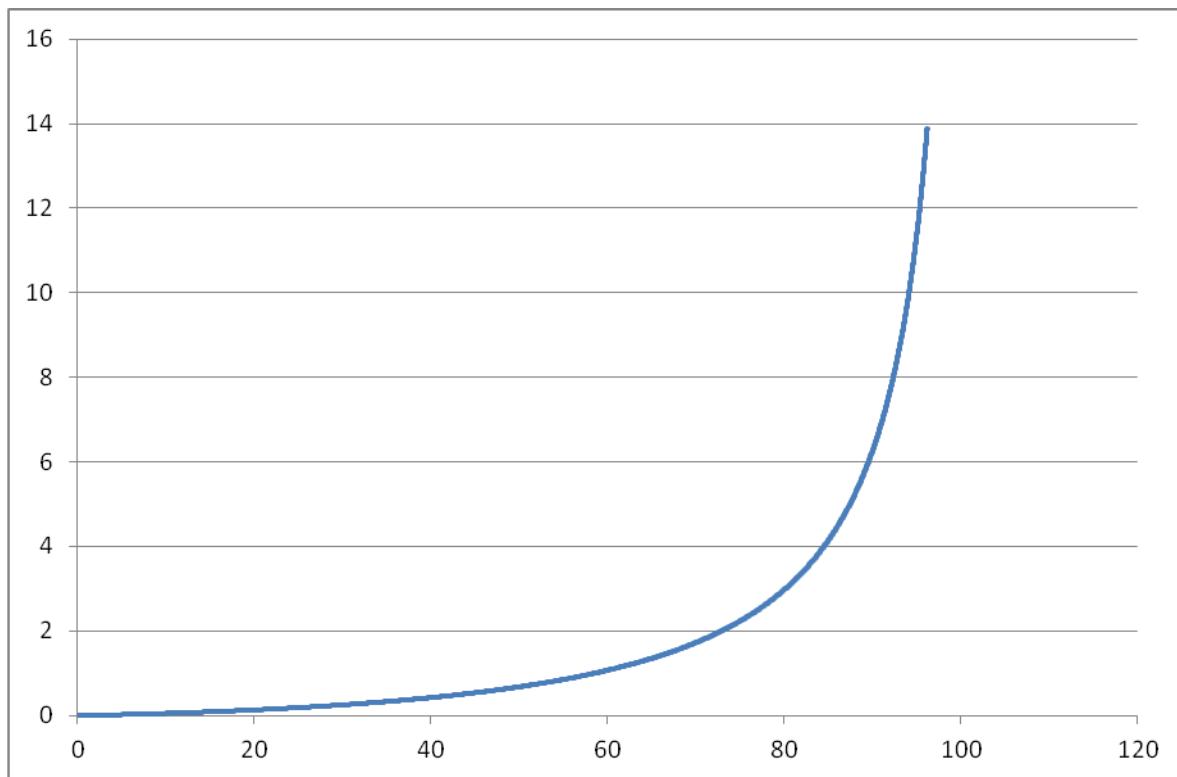
Ilustración 9.- hf 10 ks 2.0

Ilustración 10.- hf 10 ks 3.0

Ilustración 11.- hf 10 ks 4.0

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3.3. Sistematización de resultados de modelaciones de eventos de riego por gravedad.

El objetivo del diseño de riego por gravedad es conseguir la aplicación de una lámina de riego requerida por el cultivo de la manera más uniforme posible conservando una eficiencia de aplicación alta. El diseño del riego consiste en determinar el gasto de aporte y el tiempo durante el cual se aplica dicho gasto en la cabecera de la melga para lograr la mayor uniformidad posible es decir, en determinar el gasto óptimo, para una longitud de melga específica y una caracterización hidrodinámica del suelo.

En el IMTA se han desarrollado dos modelos para simulación del riego por gravedad, uno de ellos basado en el empleo de las ecuaciones de Saint-Venant y Richards y el otro es una forma simplificada en la cual en lugar de usar la ecuación de Richards para el cálculo de la infiltración del agua en el suelo, se hace uso de la ecuación de Green y Ampt, lo cual representa una reducción significativa en el tiempo de cómputo requerido para la ejecución de los cálculos. Se hace necesario comparar los resultados que se obtienen mediante la aplicación e ambos modelos para el cálculo del gasto óptimo de riego en diez tipos de suelos seleccionados de acuerdo con el triángulo de las texturas, a fin de conocer el grado de aproximación que tiene el modelo simplificado con respecto al modelo hidrodinámico completo.

A) Resultados de láminas de riego

Cuadro 1.- Lámina de riego 8 cm.

Textura del suelo	Contenido de humedad a saturación (θs)	Punto de marchitamiento permanente (θpmp)	Conductividad hidráulica a saturación (Ks)	Presión en el frente de humedecimiento (hf)	Gasto óptimo de riego L=100 metros	Gasto óptimo de riego L=200 metros	Gasto óptimo de riego L=300 metros
	(cm^3/cm^3)	(cm^3/cm^3)	(cm/h)	(cm)	cm2/s	cm2/s	cm2/s
Arcilla	0.525	0.24	0.01	132.5	0.603	0.895	1.177
Arcilla limosa	0.5	0.21	0.015	94.7	0.634	0.946	1.238
Franco-arcillo-limoso	0.5	0.20	0.07	57.8	1.023	1.987	2.940
Franco-arcilloso	0.475	0.19	0.15	34.15	1.464	2.829	4.194
Arcilla arenosa	0.425	0.23	0.2	23.7	1.546	2.993	4.465
Limo	0.5	0.09	0.5	30.7	4.239	8.328	12.368
Franco	0.475	0.14	0.7	19.2	4.689	9.279	13.795
Franco limoso	0.525	0.13	0.6	29.35	5.346	10.518	15.664
Franco-arcillo-arenoso	0.425	0.15	1.5	33.35	13.776	27.277	40.779
Franco arenoso	0.45	0.09	5	9.52	25.128	50.258	76.211

Cuadro 2.- Lámina de riego 10 cm.

Textura del suelo	Contenido de humedad a saturación (θs) (cm³/cm³)	Punto de marchitamiento permanente (θpmp) (cm³/cm³)	Conductividad hidráulica a saturación (Ks) (cm/h)	Presión en el frente de humedecimiento (hf) (cm)	Gasto óptimo de riego L=100 metros cm2/s	Gasto óptimo de riego L=200 metros cm2/s	Gasto óptimo de riego L=300 metros cm2/s
Arcilla	0.525	0.24	0.01	132.5	0.283	0.506	0.749
Arcilla limosa	0.5	0.21	0.015	94.7	0.288	0.536	0.784
Franco-arcillo-limoso	0.5	0.20	0.07	57.8	0.886	1.685	2.527
Franco-arcilloso	0.475	0.19	0.15	34.15	1.353	2.507	3.660
Arcilla arenosa	0.425	0.23	0.2	23.7	1.371	2.618	3.890
Limo	0.5	0.09	0.5	30.7	3.709	7.267	10.752
Franco	0.475	0.14	0.7	19.2	4.181	8.188	12.195
Franco limoso	0.525	0.13	0.6	29.35	4.620	9.040	13.486
Franco-arcillo-arenoso	0.425	0.15	1.5	33.35	11.805	23.210	34.691
Franco arenoso	0.45	0.09	5	9.52	22.784	45.568	67.802

Cuadro 3.- Lámina de riego 12 cm.

Textura del suelo	Contenido de humedad a saturación (θs) (cm³/cm³)	Punto de marchitamiento permanente (θpmp) (cm³/cm³)	Conductividad hidráulica a saturación (Ks) (cm/h)	Presión en el frente de humedecimiento (hf) (cm)	Gasto óptimo de riego L=100 metros cm2/s	Gasto óptimo de riego L=200 metros cm2/s	Gasto óptimo de riego L=300 metros cm2/s
Arcilla	0.525	0.24	0.01	132.5	0.625	0.833	1.021
Arcilla limosa	0.5	0.21	0.015	94.7	0.462	0.674	0.895
Franco-arcillo-limoso	0.5	0.20	0.07	57.8	0.766	1.472	2.168
Franco-arcilloso	0.475	0.19	0.15	34.15	1.153	2.206	3.259
Arcilla arenosa	0.425	0.23	0.2	23.7	1.236	2.397	3.557
Limo	0.5	0.09	0.5	30.7	3.360	6.545	9.704
Franco	0.475	0.14	0.7	19.2	3.843	7.487	11.155
Franco limoso	0.525	0.13	0.6	29.35	4.715	8.15	12.101
Franco-arcillo-arenoso	0.425	0.15	1.5	33.35	10.602	20.728	30.929
Franco arenoso	0.45	0.09	5	9.52	21.650	42.476	63.852

NOTA: Se retomaron las características con las cuales se corrió el MHC.

Lámina de riego (8 cm)

Cuadro 4.- Gasto óptimo de texturas de suelo, lámina de riego 8 cm.

Arcilla	
Longitud (m)	**Qopt**
0	0
200	0.603
300	0.895
400	1.238
Arcilla limosa	
Longitud (m)	**Qopt**
0	0
200	0.6338
300	0.9457
400	1.177
Franco arcillo limoso	
Longitud (m)	**Qopt**
0	0
100	1.023
200	1.987
300	2.94
Franco arcilloso	
Longitud (m)	**Qopt**
0	0
100	1.464
200	2.829
300	4.194
Arcilla arenosa	
Longitud (m)	**Qopt**
0	0
100	1.546
200	2.993
300	4.465

Limo	
Longitud (m)	**Qopt**
0	0
100	4.239
200	8.238
300	12.368
Franco	
Longitud (m)	**Qopt**
0	0
100	4.689
200	9.279
300	13.795
Franco limoso	
Longitud (m)	**Qopt**
0	0
100	5.346
200	10.518
300	15.664
Franco arcillo arenoso	
Longitud (m)	**Qopt**
0	0
100	13.776
200	27.277
300	40.779
Franco arenoso	
Longitud (m)	**Qopt**
0	0
100	25.128
200	50.258
300	76.211
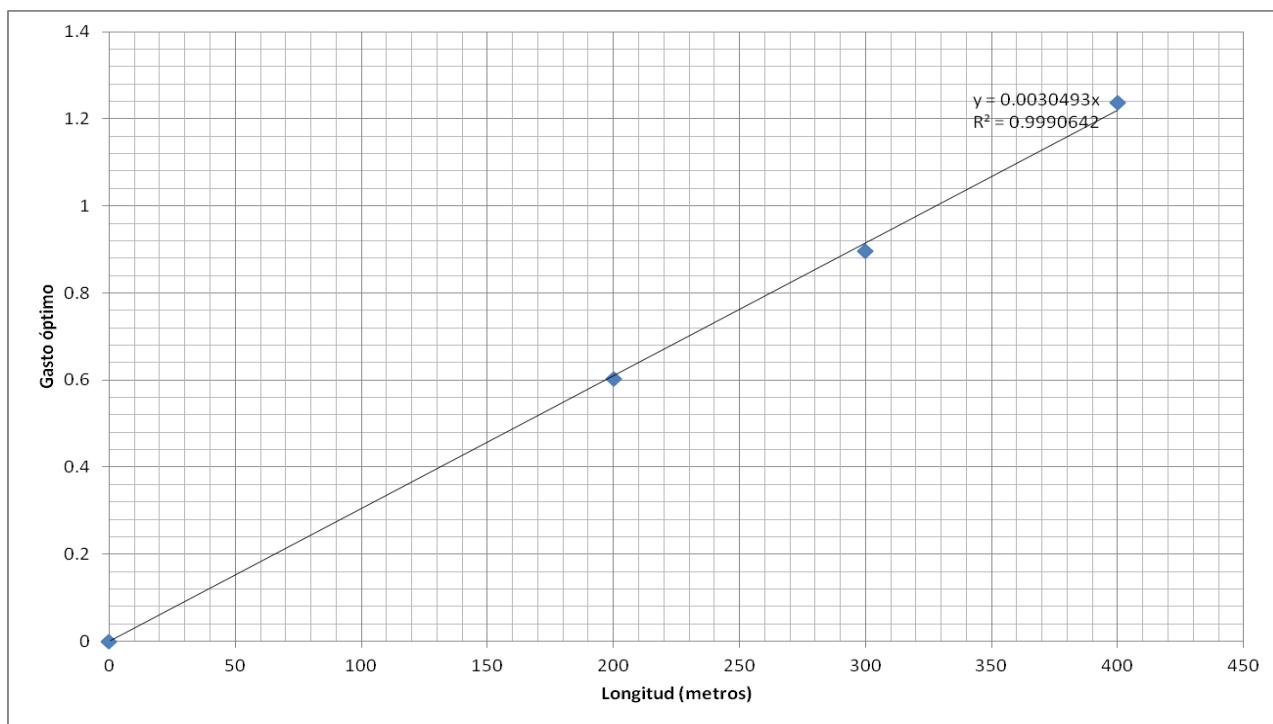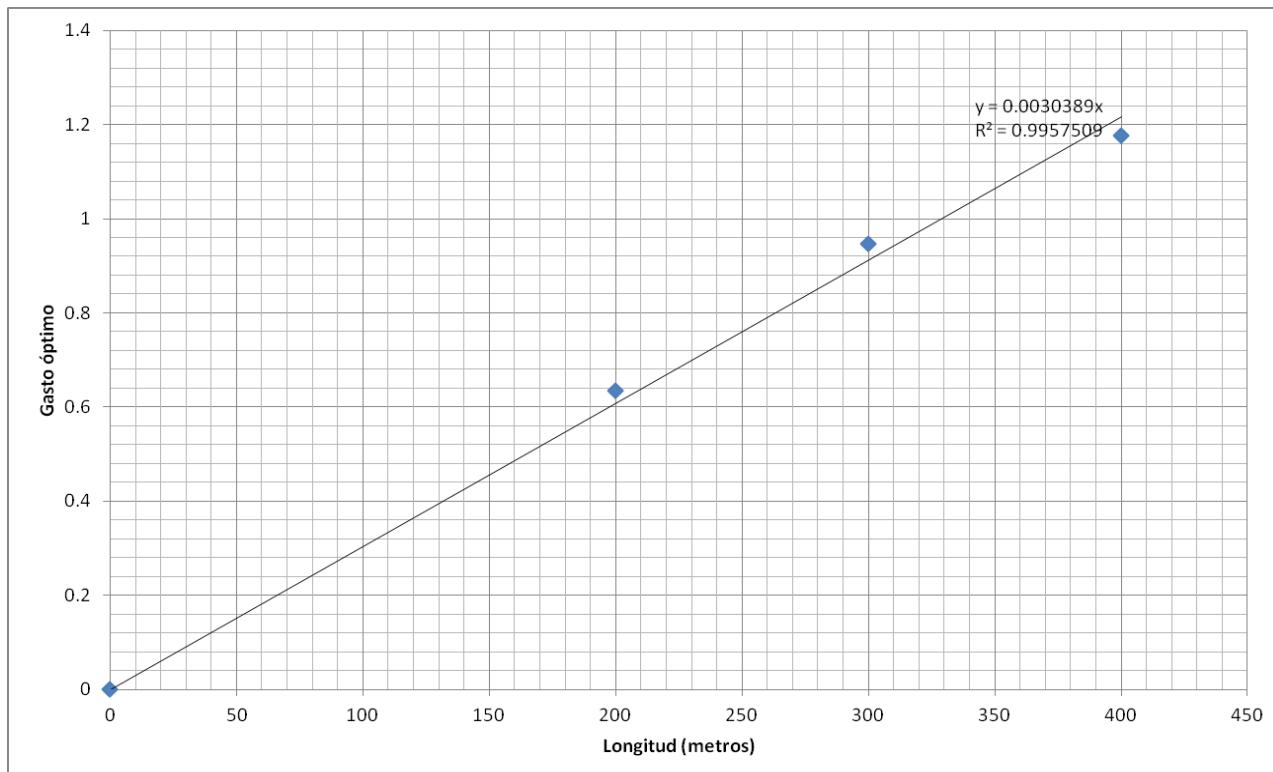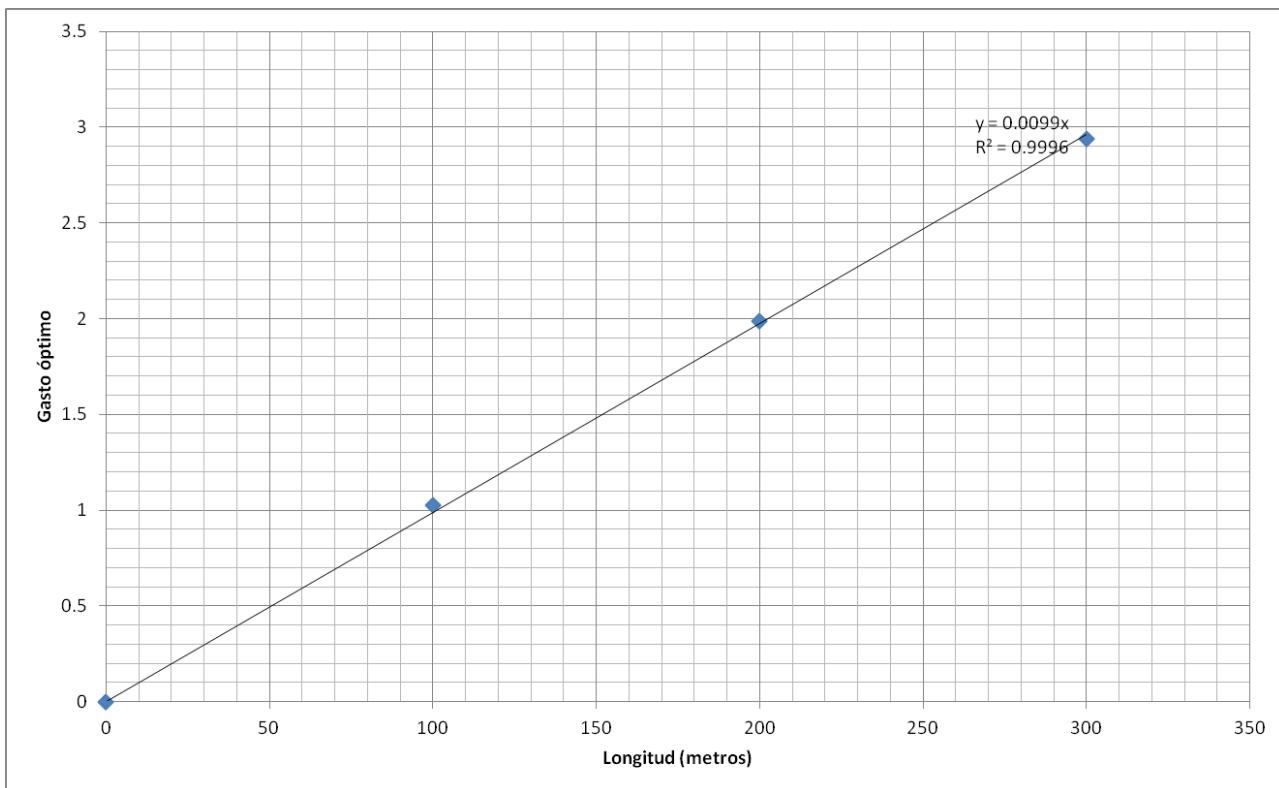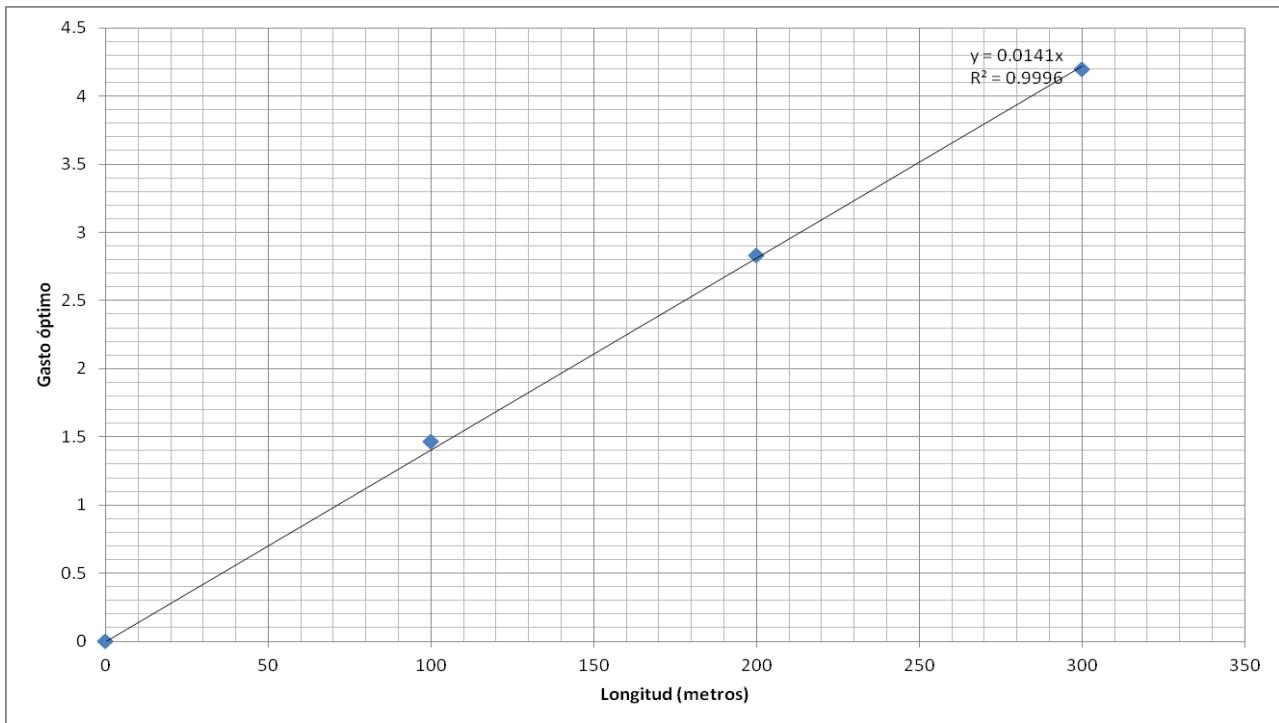
Ilustración 13.- Gasto óptimo de la textura de suelo arcilla, lámina de riego 8 cm.

$y = 0.0030493x$
$R^2 = 0.9990642$
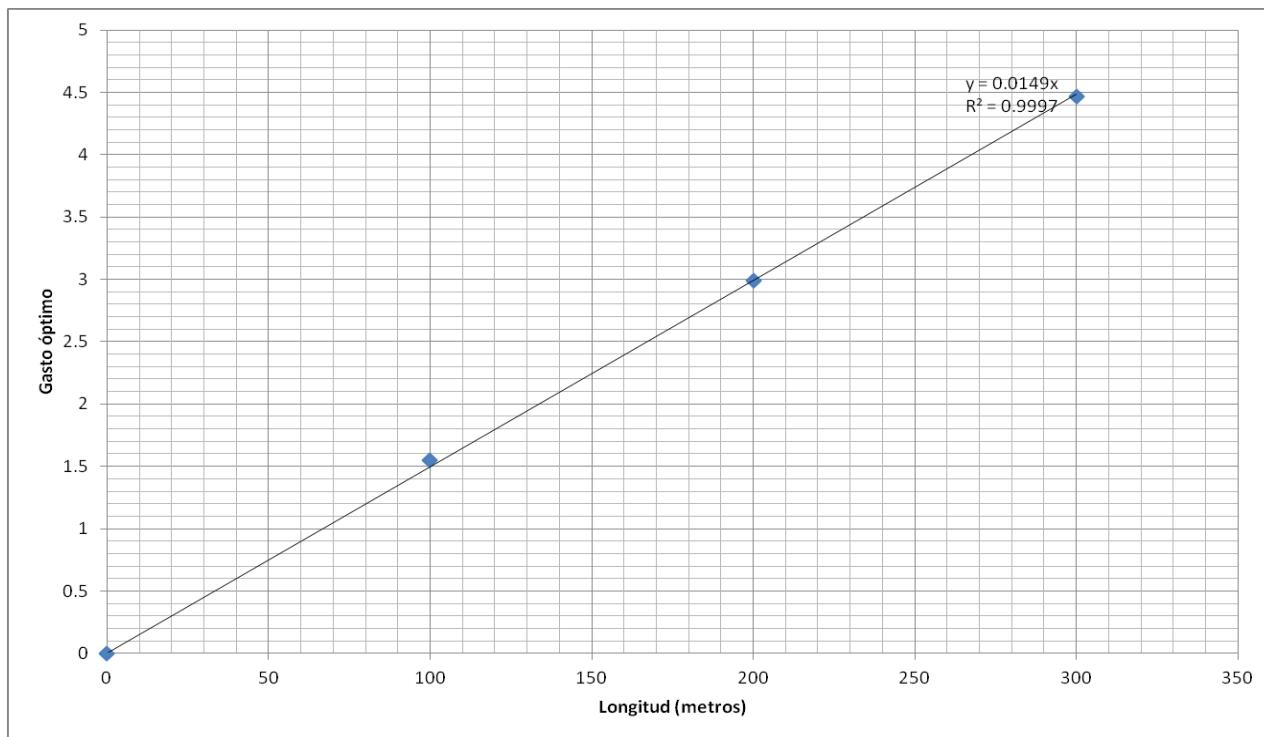
Ilustración 14.- Gasto óptimo de la textura de suelo arcilla limosa, lámina de riego 8 cm.

$y = 0.0030389x$
$R^2 = 0.9957509$
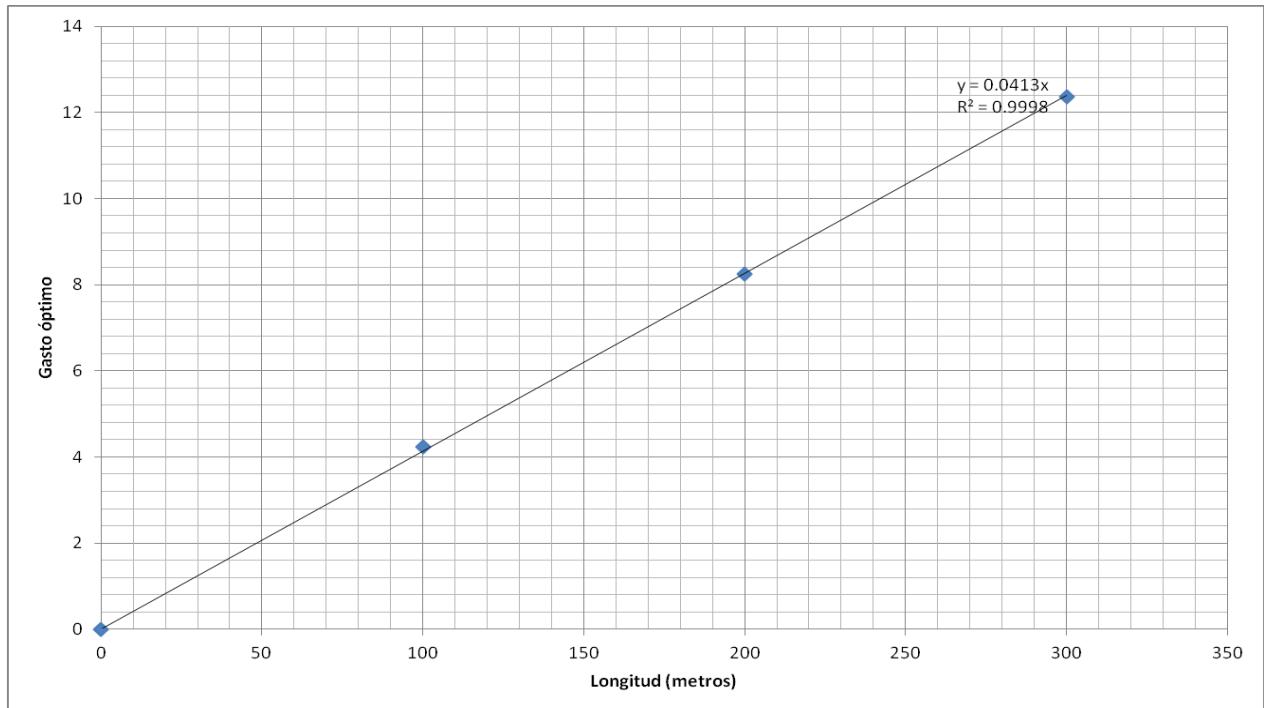
Ilustración 15.- Gasto óptimo de la textura de suelo franco arcillo limoso, lámina de riego 8 cm.
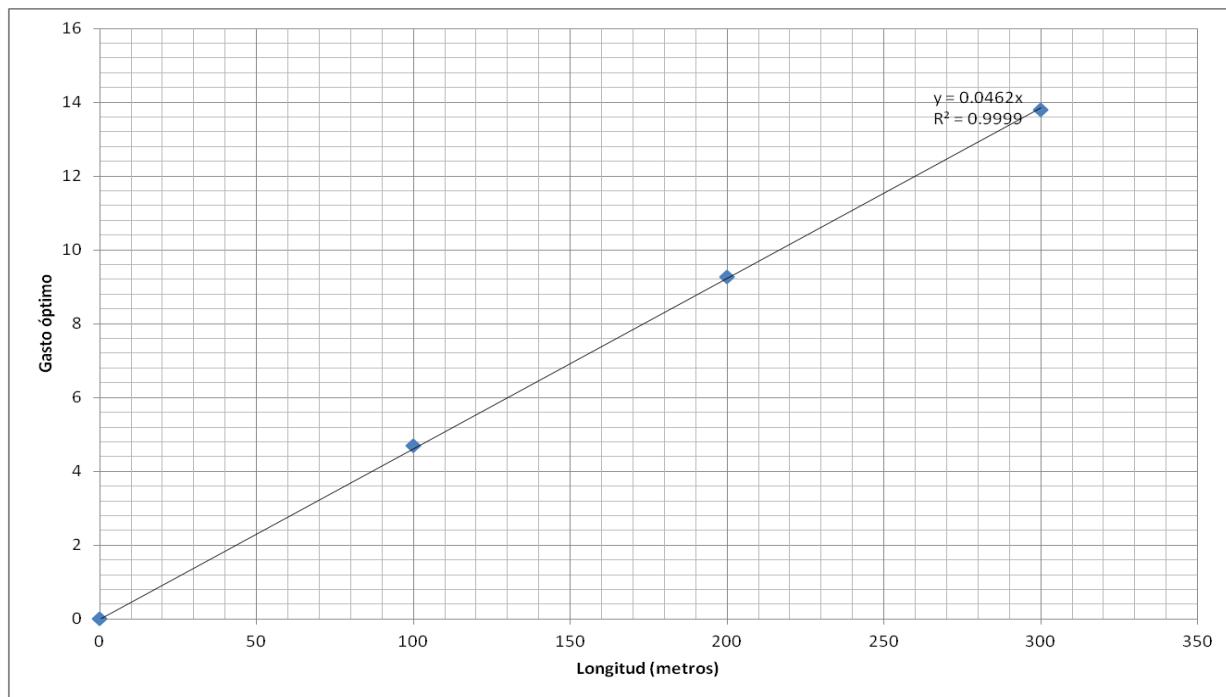
Ilustración 16.- Gasto óptimo de la textura de suelo franco arcilloso, lámina de riego 8 cm
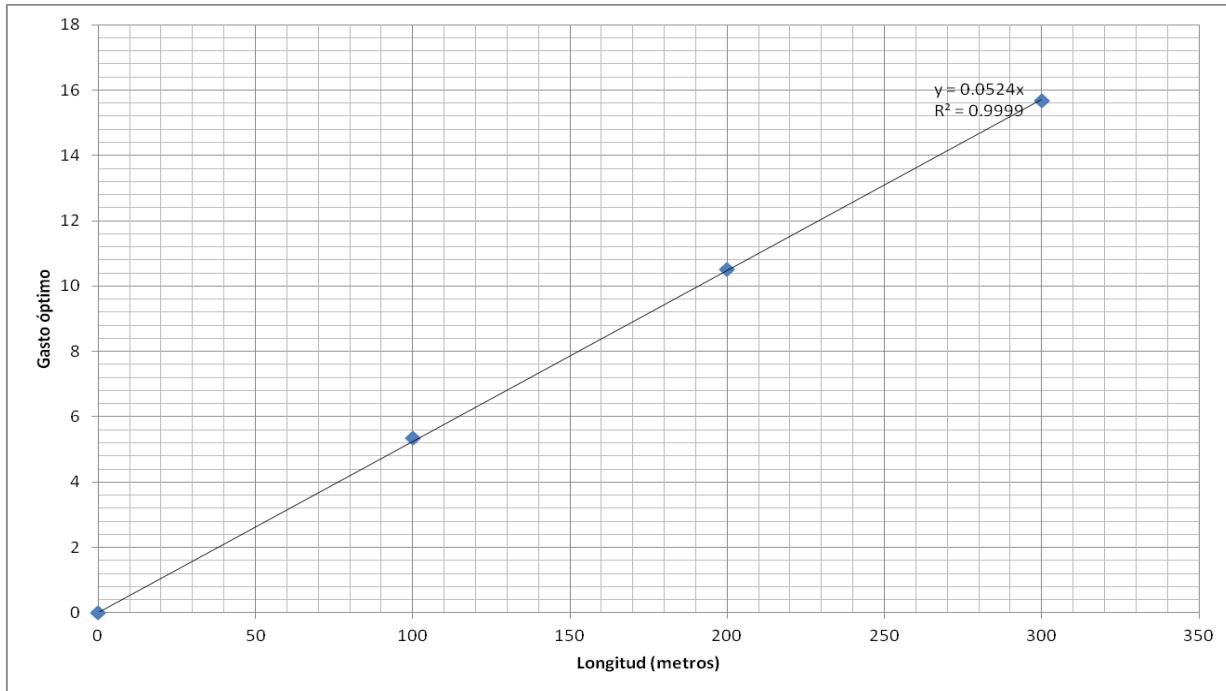
Ilustración 17.- Gasto óptimo de la textura de suelo arcilla arenosa, lámina de riego 8 cm.
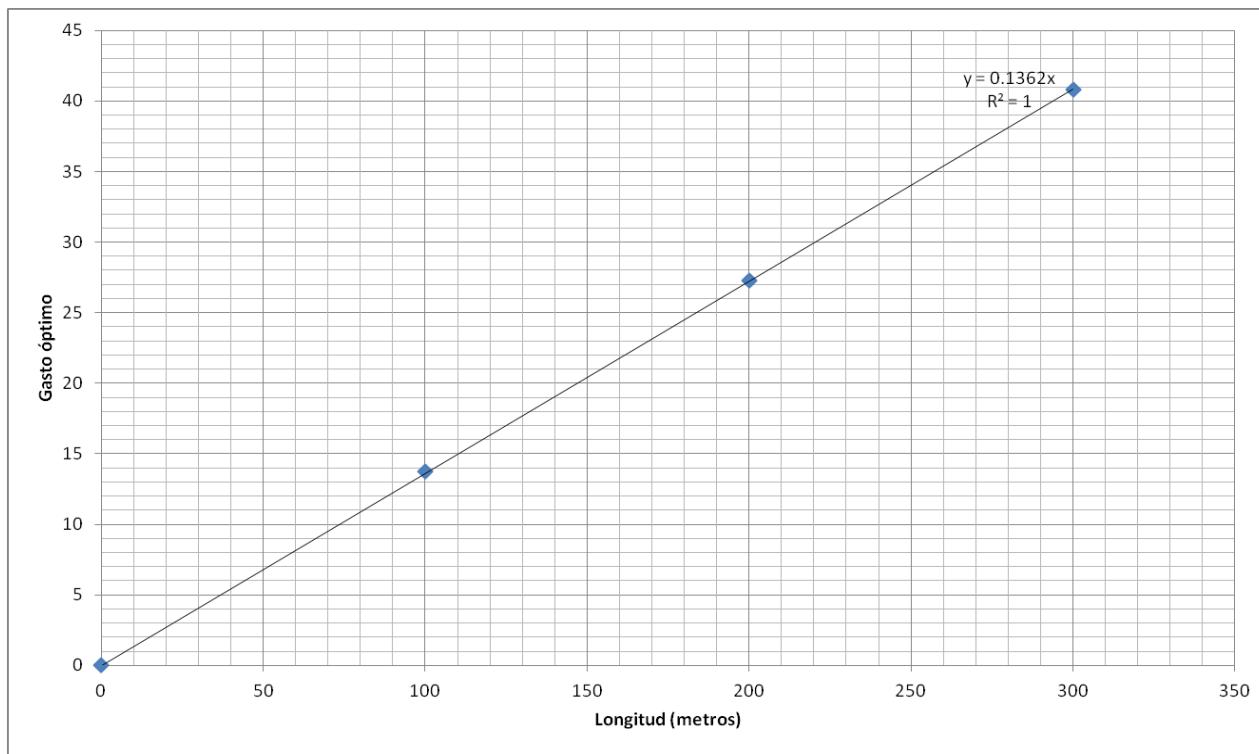
Ilustración 18.- Gasto óptimo de la textura de suelo limo, lámina de riego 8 cm.
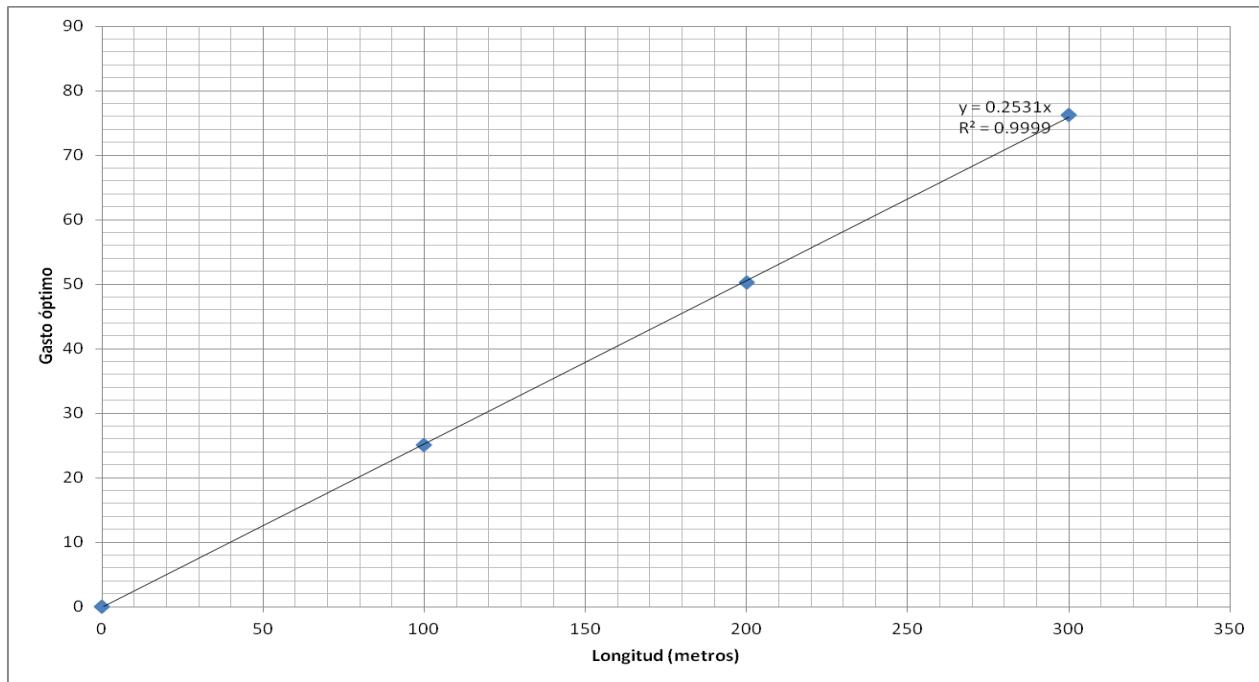
Ilustración 19.- Gasto óptimo de la textura de suelo franco, lámina de riego 8 cm.

Ilustración 20.- Gasto óptimo de la textura de suelo franco limoso, lámina de riego 8 cm.

Ilustración 21.- Gasto óptimo de la textura de suelo franco arcillo arenoso, lámina de riego 8 cm.

Ilustración 22.- Gasto óptimo de la textura de suelo franco arenoso, lámina de rego 8 cm.

Lámina de riego (10 cm)

Cuadro 5.- Gasto óptimo de texturas de suelo, lámina de riego 10 cm.

Arcilla	
Longitud (m)	**Qopt**
0	0
100	0.283
200	0.506
300	0.749

Arcilla limosa	
Longitud (m)	**Qopt**
0	0
100	0.288
200	0.506
300	0.784

Franco arcillo limoso	
Longitud (m)	**Qopt**
0	0
100	0.886
200	1.685
300	2.4

Franco arcilloso	
Longitud (m)	**Qopt**
0	0
100	1.278
200	2.507
300	3.66

Arcilla arenosa	
Longitud (m)	**Qopt**
0	0
100	1.371
200	2.618
300	3.89

Limo	
Longitud (m)	**Qopt**
0	0
100	3.709
200	7.267
300	10.752

Franco	
Longitud (m)	**Qopt**
0	0
100	4.181
200	8.188
300	12.195
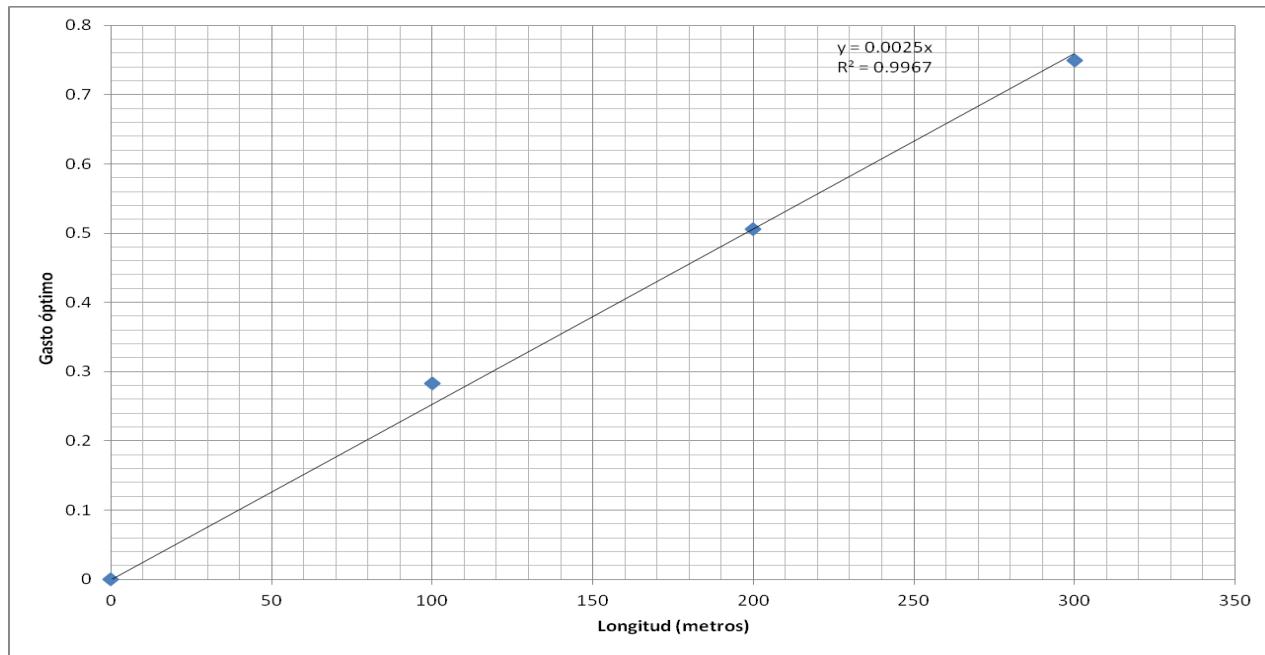
Franco limoso	
Longitud (m)	**Qopt**
0	0
100	4.62
200	9.04
300	13.486
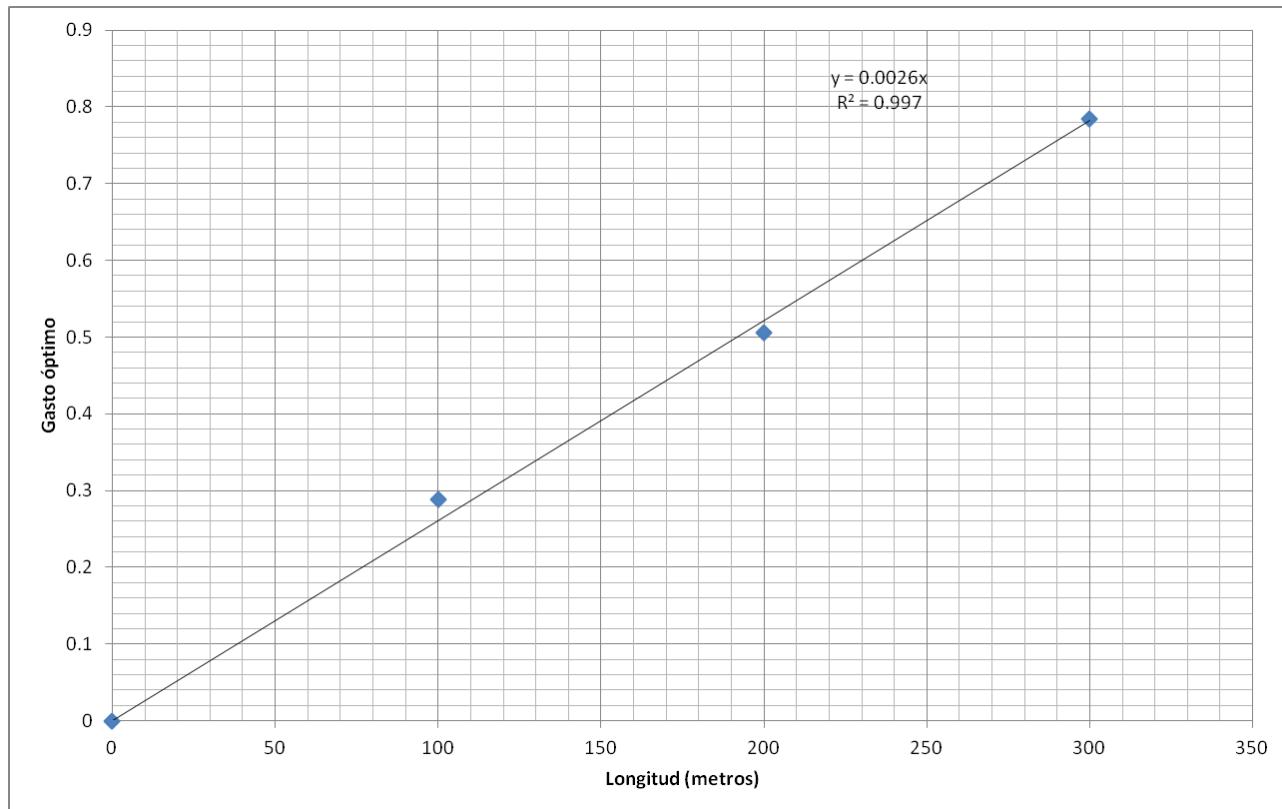
Franco arcillo arenoso	
Longitud (m)	**Qopt**
0	0
100	11.805
200	23.21
300	34.691
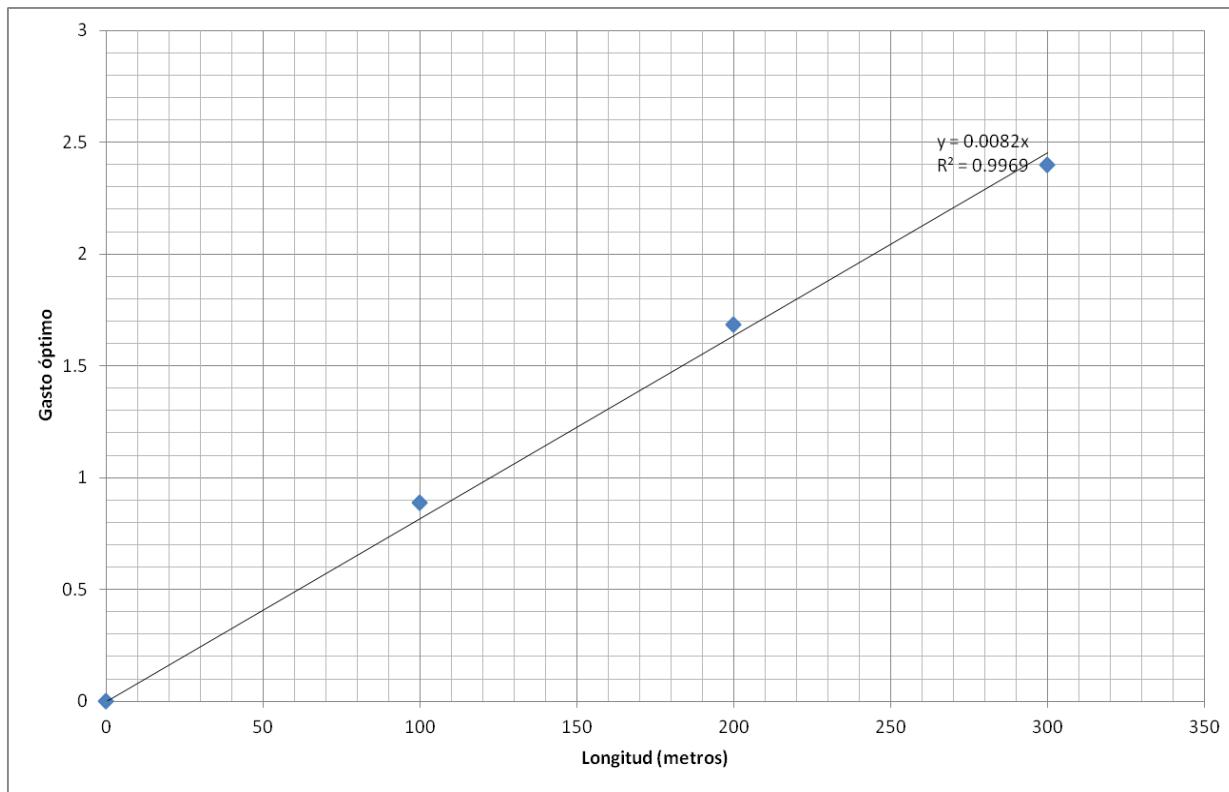
Franco arenoso	
Longitud (m)	**Qopt**
0	0
100	22.784
200	45.568
300	67.802
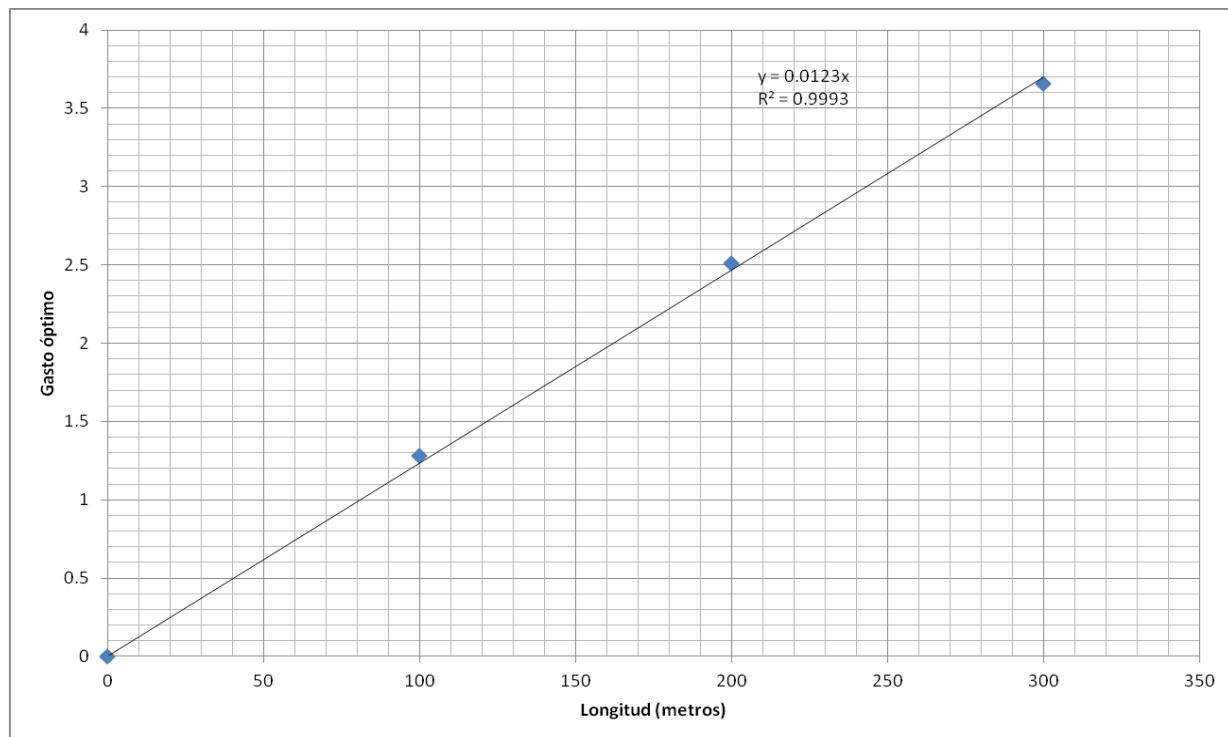
Ilustración 23.- Gasto óptimo de la textura de suelo arcilla, lámina 10 cm.
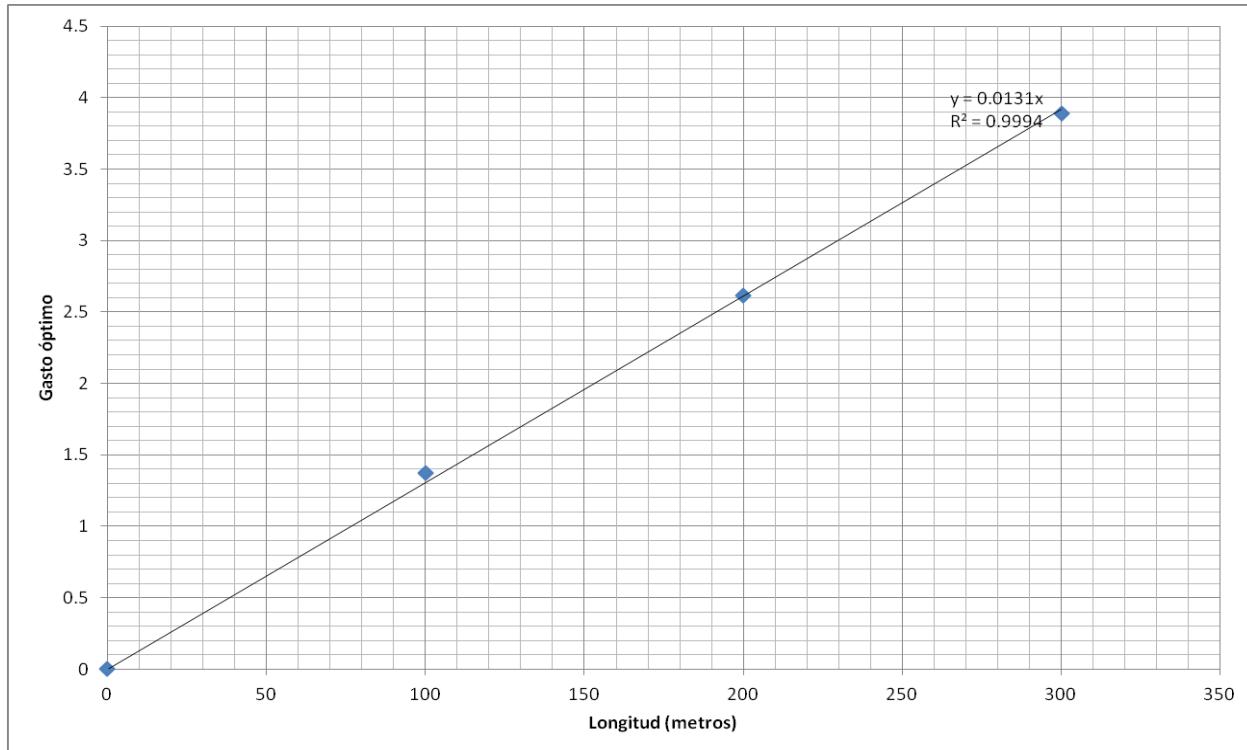
Ilustración 24.- Gasto óptimo de la textura de suelo arcilla limosa, lámina de riego 10 cm.
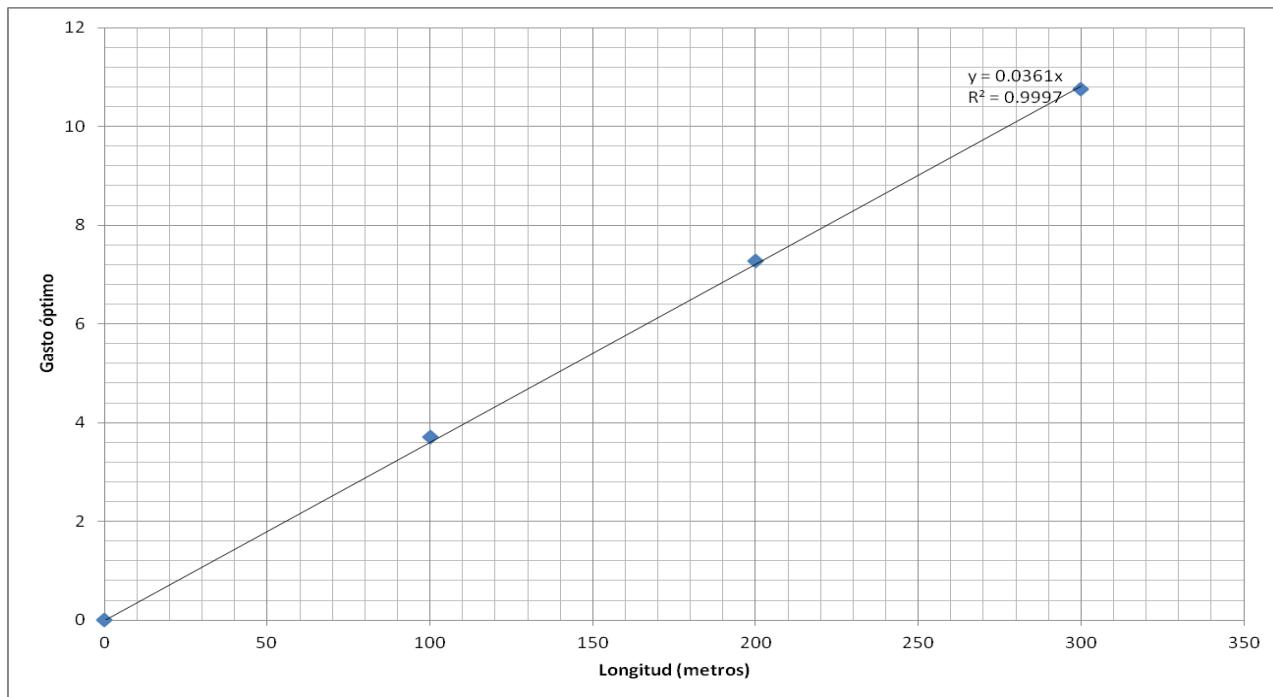
Ilustración 25.- Gasto óptimo de la textura de suelo franco arcillo limoso, lámina de riego 10 cm.
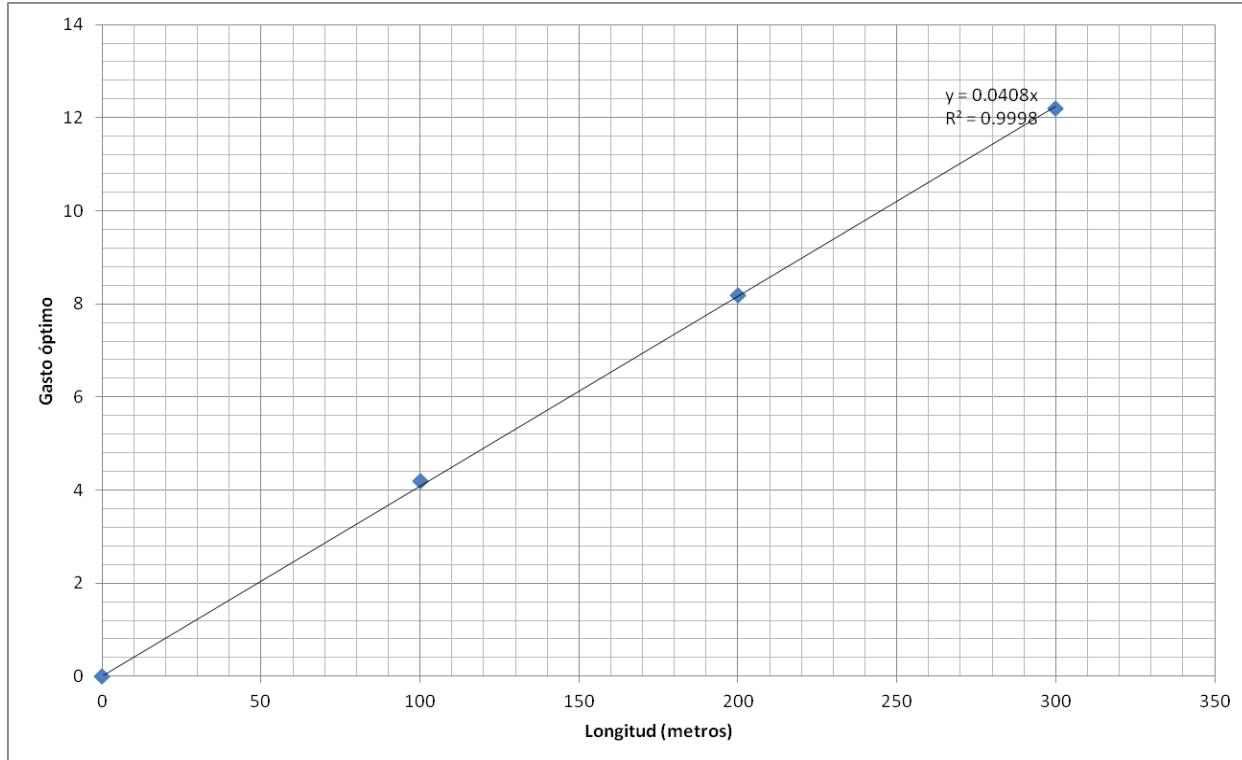
Ilustración 26.- Gasto óptimo de la textura de suelo franco arcilloso, lámina de riego 10 cm.
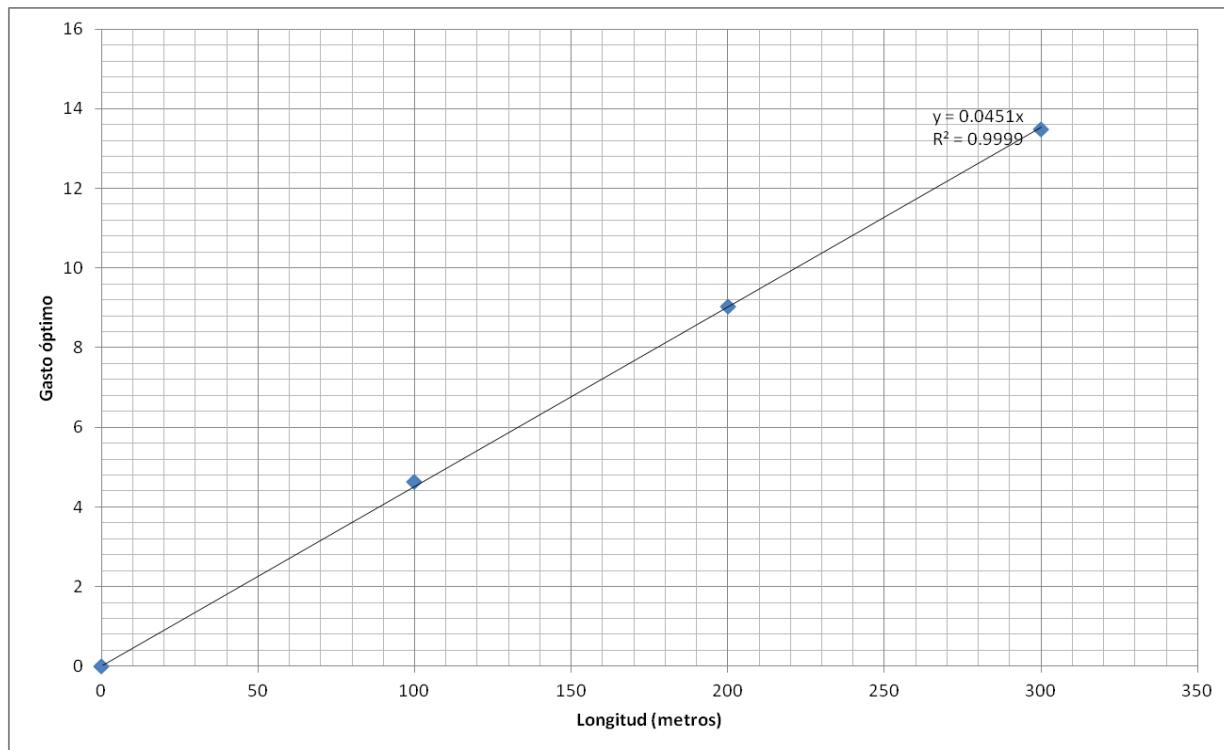
Ilustración 27.- Gasto óptimo de la textura de suelo arcilla arenosa, lámina de riego 10 cm.
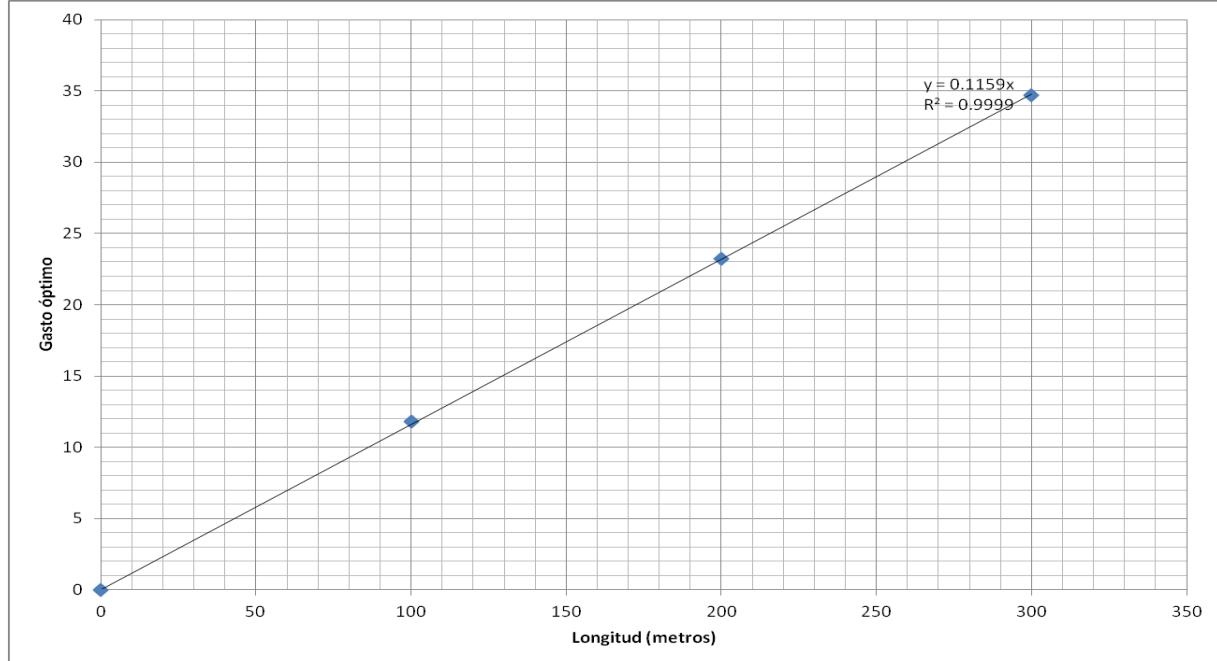
Ilustración 28.- Gasto óptimo de la textura de suelo limo, lámina de riego 10 cm.
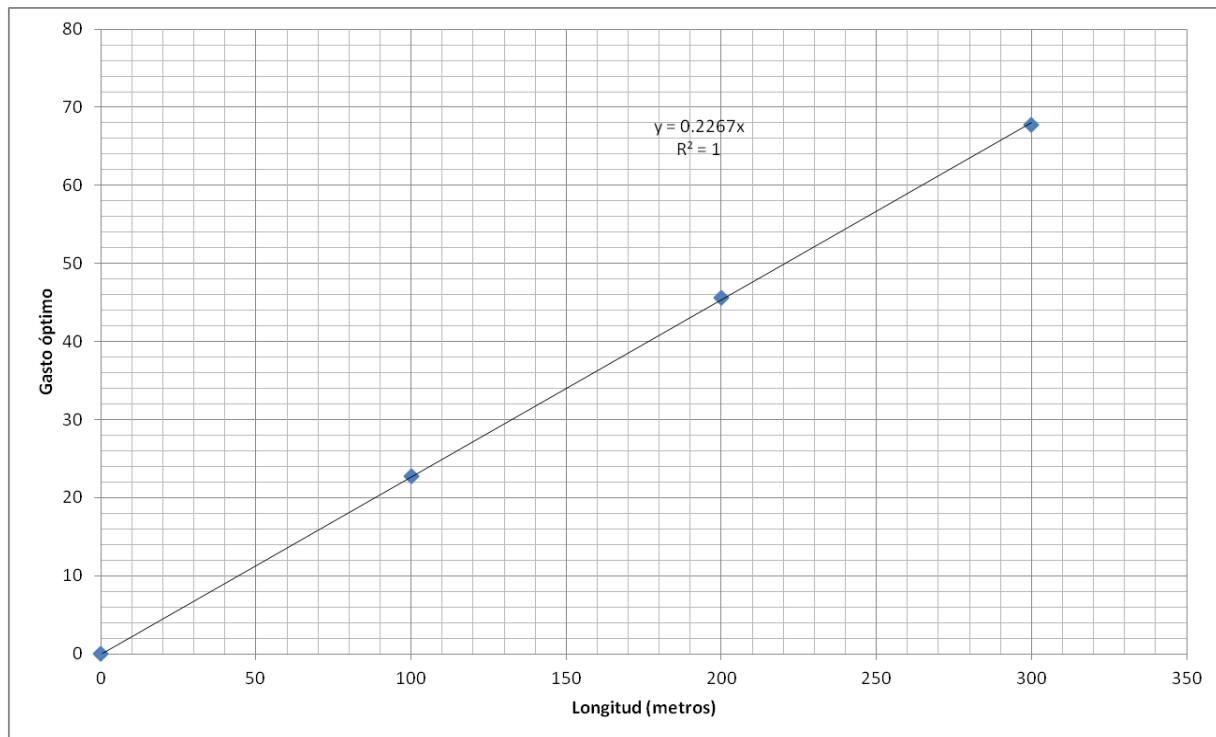
Ilustración 29.- Gasto óptimo de la textura de suelo arcilla, lámina de riego 10 cm.

Ilustración 30.- Gasto óptimo de la textura de suelo franco limoso, lámina de riego 10 cm.

Ilustración 31.- Gasto óptimo de la textura de suelo franco arcillo arenoso, lámina de riego 10 cm.

Ilustración 32.- Gasto óptimo de la textura de suelo franco arenoso, lámina de riego 10 cm.

Within the chart:

$$y = 0.2267x$$
$$R^2 = 1$$

Lámina de riego (12 cm)

Cuadro 6.- Gasto óptimo de texturas de suelo, lámina de riego 12 cm

Arcilla	
Longitud (m)	Qopt
0	0
300	0.624
400	0.833
500	1.021

Arcilla limosa	
Longitud (m)	Qopt
0	0
200	0.462
300	0.674
400	0.895

Franco arcillo limoso	
Longitud (m)	Qopt
0	0
100	0.766
200	1.472
300	2.168

Franco arcilloso	
Longitud (m)	Qopt
0	0
100	1.153
200	2.206
300	3.259

Arcilla arenosa	
Longitud (m)	Qopt
0	0
100	1.236
200	2.397
300	3.557

Limo	
Longitud (m)	Qopt
0	0
100	3.36
200	6.545
300	9.704

Franco	
Longitud (m)	Qopt
0	0
100	3.843
200	7.487
300	11.155
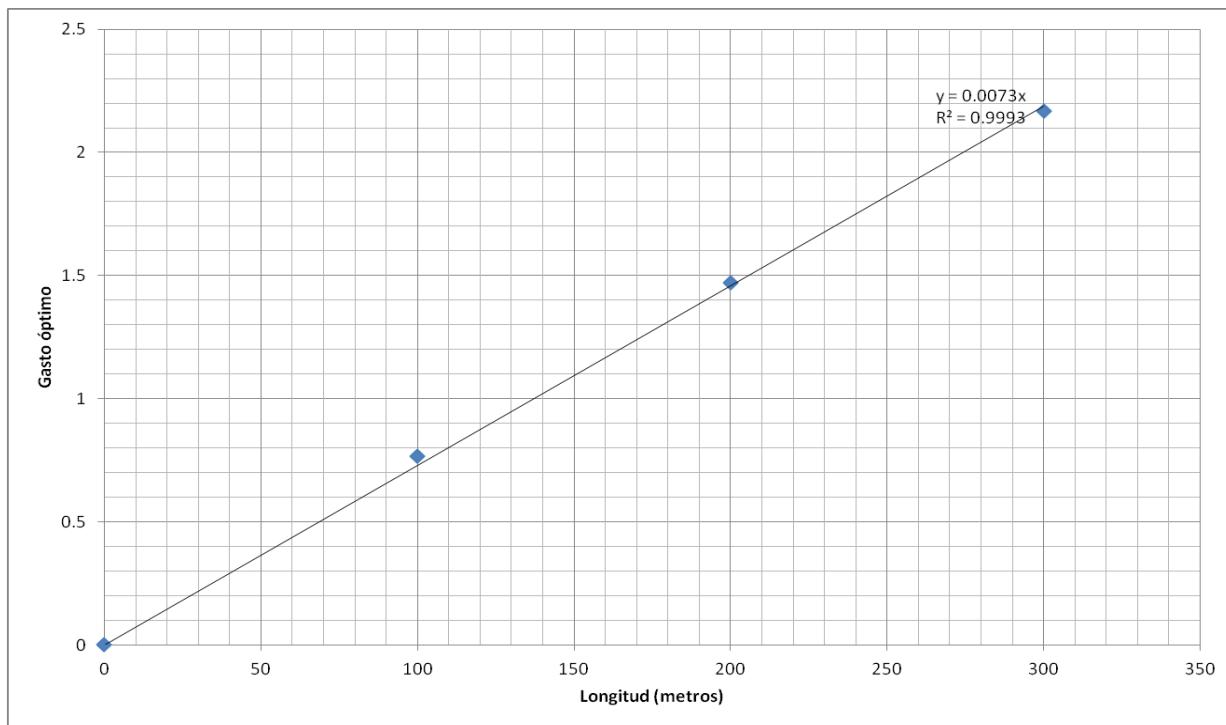
Franco limoso	
Longitud (m)	Qopt
0	0
100	4.175
200	8.15
300	12.101
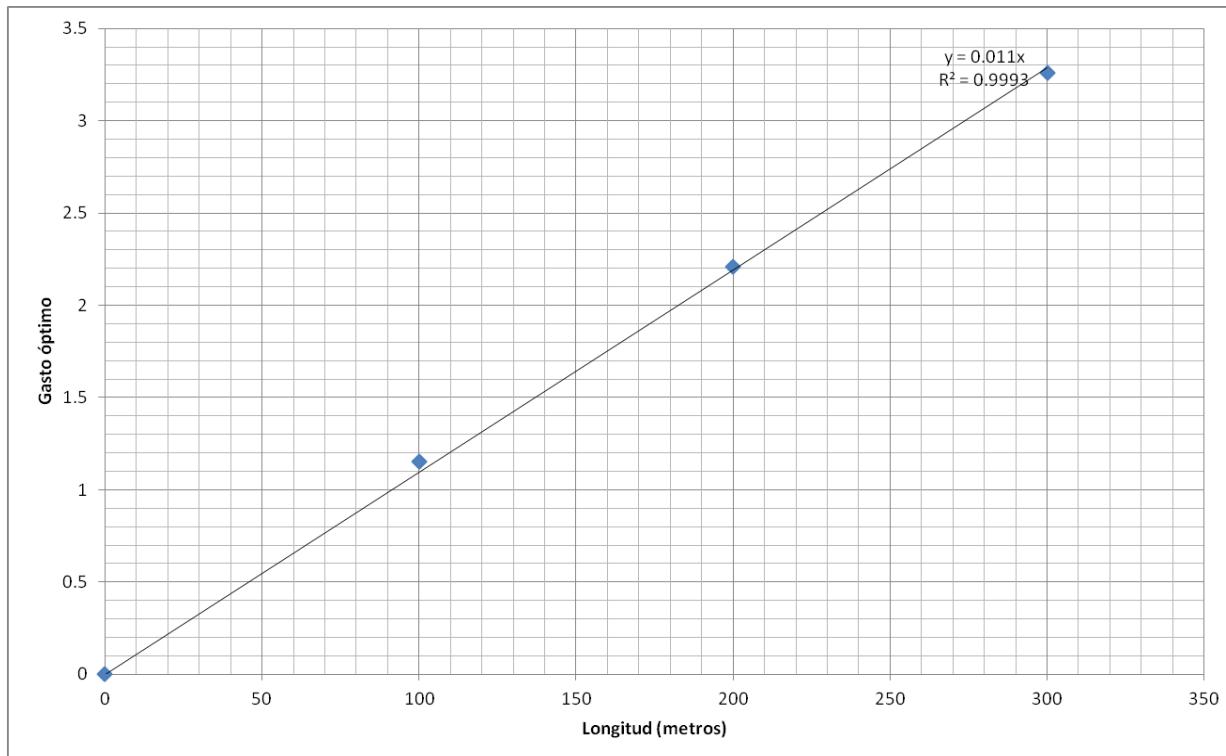
Franco arcillo arenoso	
Longitud (m)	Qopt
0	0
100	10.78
200	20.728
300	30.929
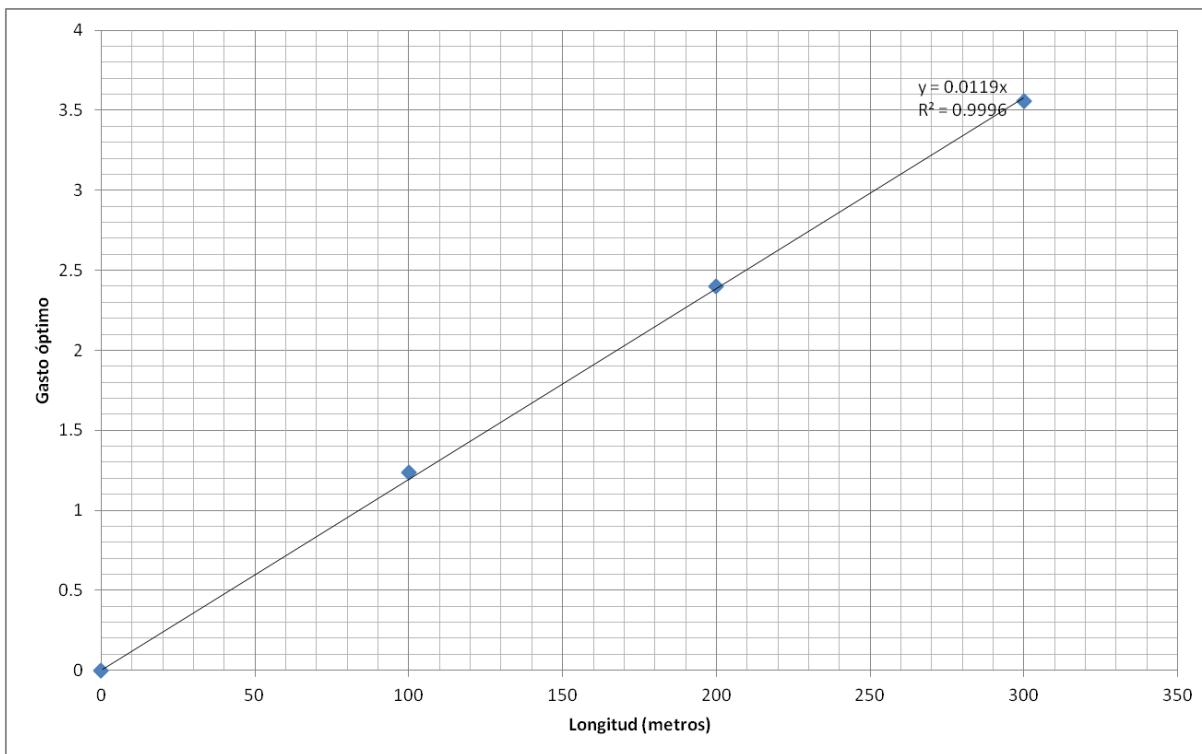
Franco arenoso	
Longitud (m)	Qopt
0	0
100	21.65
200	42.476
300	63.852
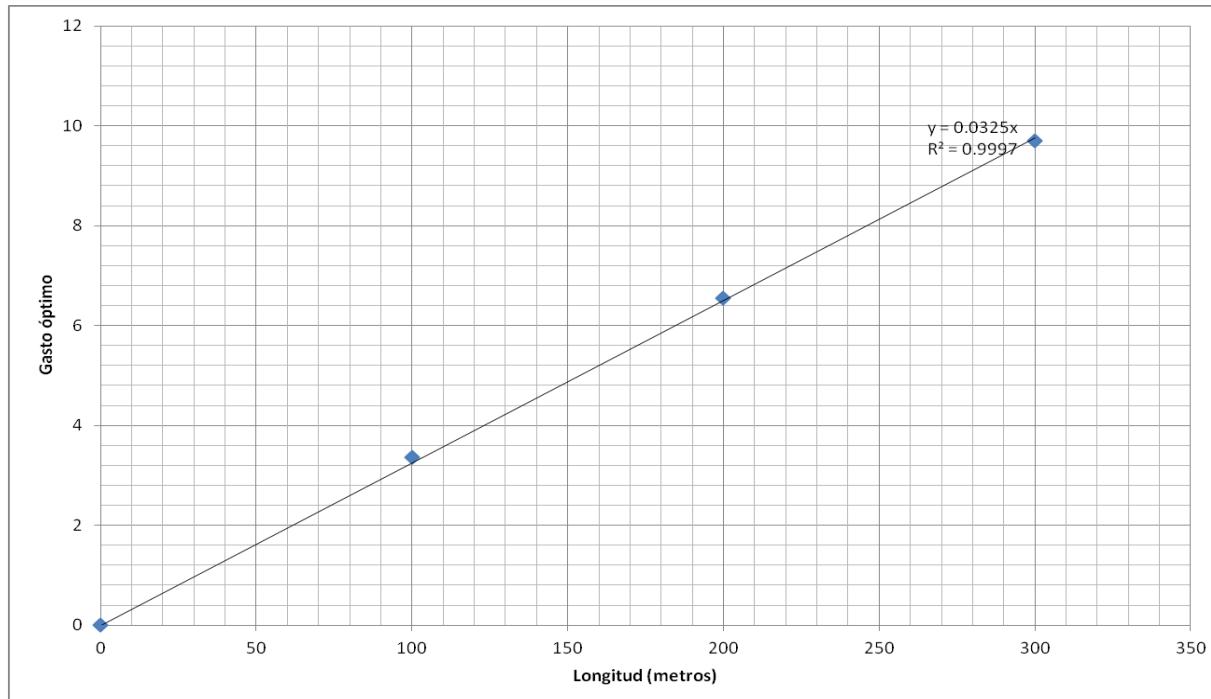
Ilustración 33.- Gasto óptimo de la textura de suelo franco arcillo limoso, lámina de riego 12 cm.
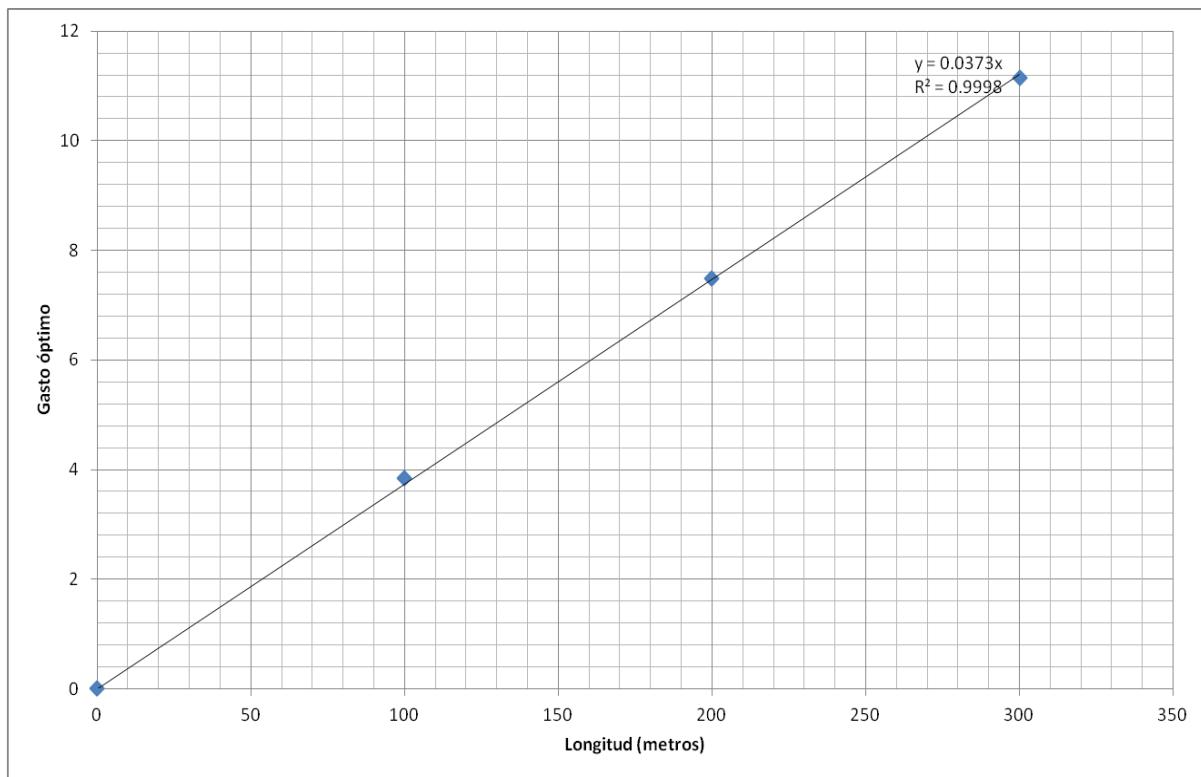
Ilustración 34.- Gasto óptimo de la textura de suelo franco arcilloso, lámina de riego 12 cm.
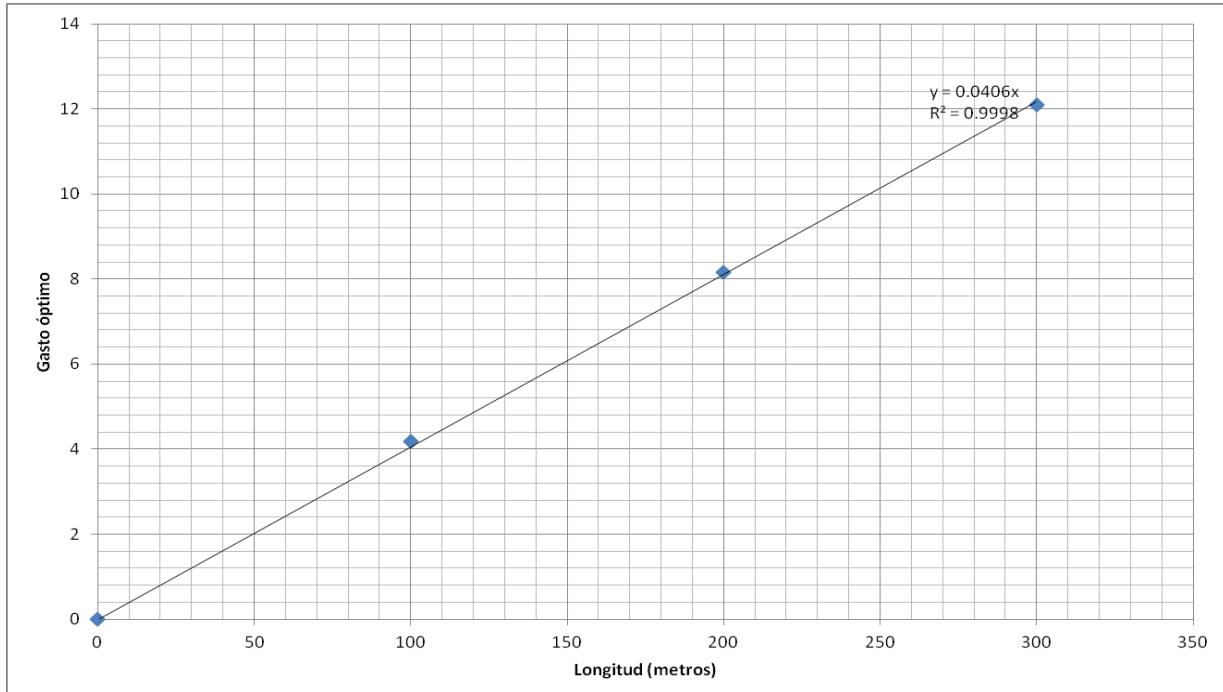
Ilustración 35.- Gasto óptimo de la textura de suelo arcilla arenosa, lámina de riego 12 cm.
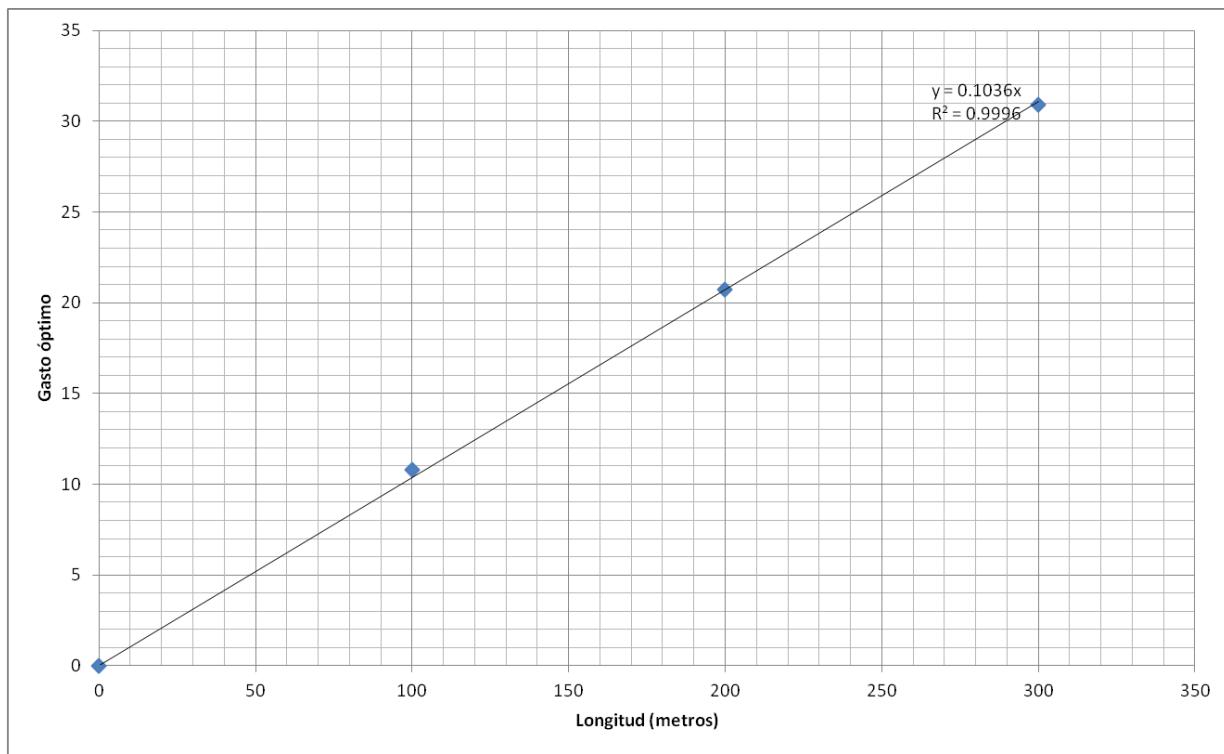
Ilustración 36.- Gasto óptimo de la textura de suelo limo, lámina de riego 12 cm.
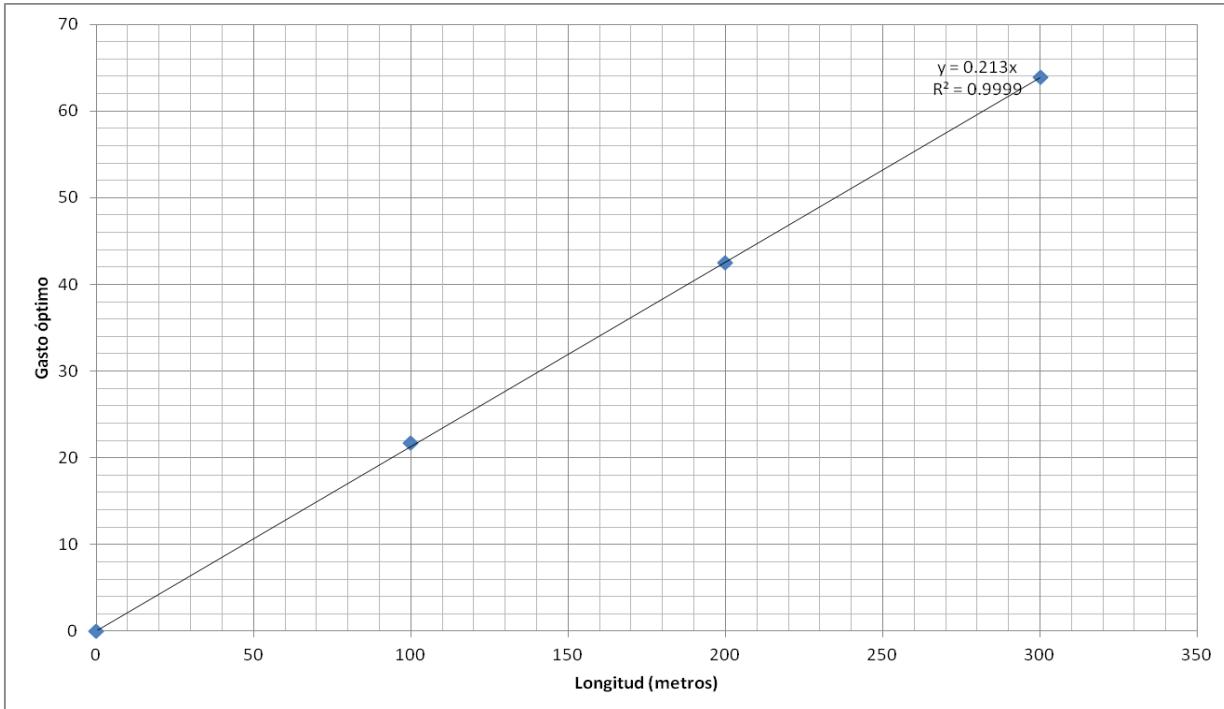
Ilustración 37.- Gasto óptimo de la textura de suelo franco, lámina de riego 12 cm.

$y = 0.0373x$
$R^2 = 0.9998$
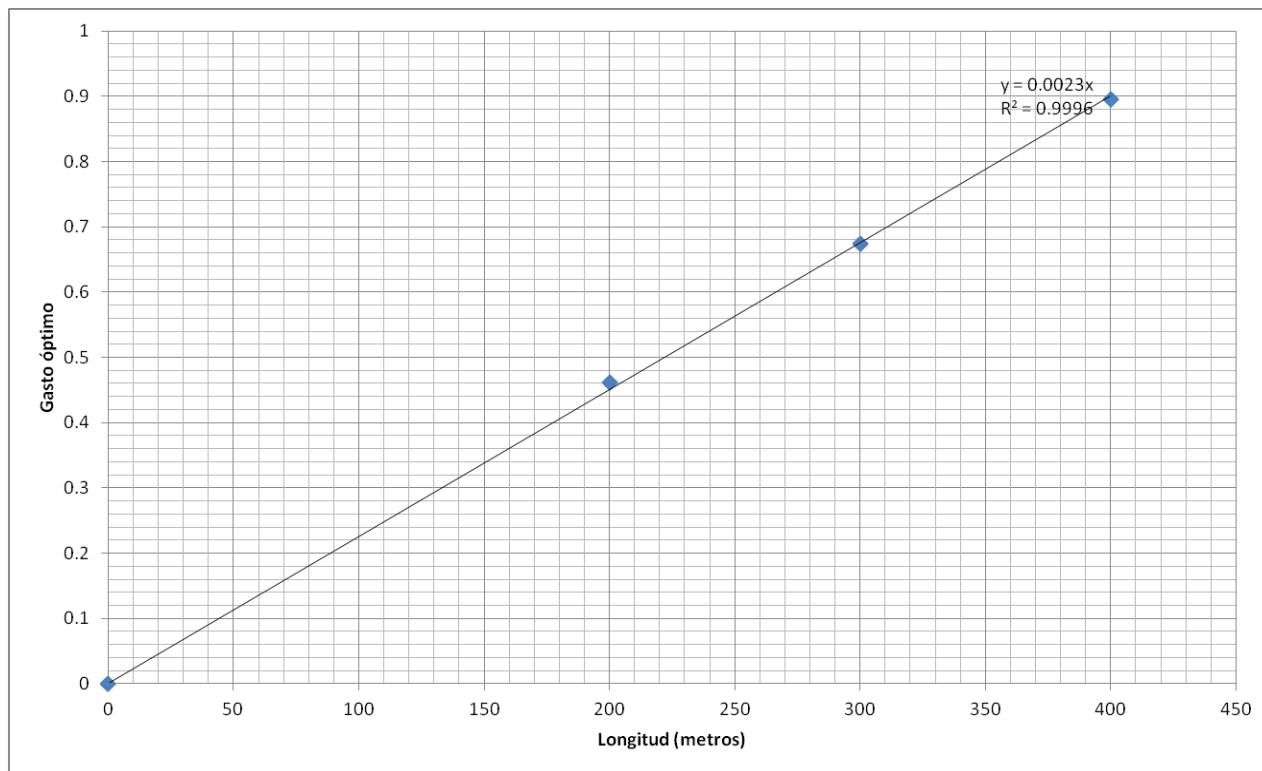
Ilustración 38.- Gasto óptimo de la textura de suelo franco limoso, lámina de riego 12 cm.

$y = 0.0406x$
$R^2 = 0.9998$
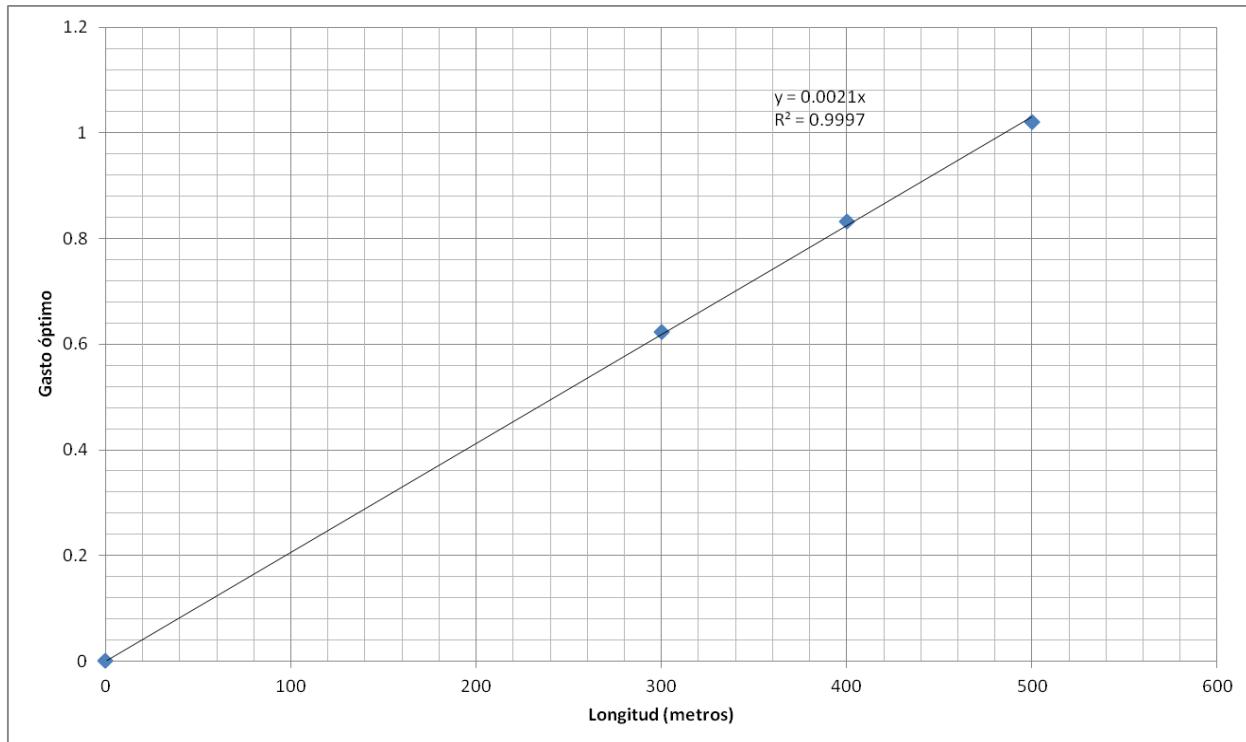
Ilustración 39.- Gasto óptimo de la textura de suelo franco arcillo arenoso, lámina de riego 12 cm.

Ilustración 40.- Gasto óptimo de la textura de suelo franco arenoso, lámina de riego 12 cm.

Ilustración 41.- Gasto óptimo de la textura de suelo arcilla limosa, lámina de riego 12 cm.


**Ilustración 42.- Gasto óptimo de la textura de suelo arcilla, lámina de riego 12 cm**

B) Diseño de riego con el modelo Saint Venant y Green y Ampt y el modelo Saint Venant y Richards

Se obtuvieron cuadros de diseño a partir de la sistematización de modelaciones de eventos de riego, dichos cuadros se muestran a continuación. Se calcularon las diferencias entre los gastos de riego que proporcionan cada uno de los cuadros (gráfica 31) y se observó que la diferencia entre los resultados crece conforme aumenta el contenido de arcilla en el suelo.

Cuadro 6.- Diseño de riego con el modelo de Saint Venant y Green y Ampt.

Textura del suelo	Lr = 8 cm			Lr = 10 cm			Lr = 12 cm		
	Q	Tr	CUC	Q	Tr	CUC	Q	Tr	CUC
	l/s/m²	(h)	-	l/s/m²	(h)	-	l/s/m²	(h)	-
Arcilla	0.000305	65.68	0.890	0.000250	72.88	0.927	0.000210	139.92	0.888
Arcilla limosa	0.000304	62.23	0.889	0.000260	73.95	0.937	0.000230	119.35	0.910
Franco-arcillo-limoso	0.000990	18.60	0.928	0.000820	25.08	0.940	0.000730	34.35	0.953
Franco-arcilloso	0.001410	12.82	0.927	0.001230	18.09	0.929	0.001100	21.99	0.953
Arcilla arenosa	0.001490	12.38	0.928	0.001310	15.82	0.942	0.001190	20.51	0.957
Limo	0.004130	4.67	0.928	0.003610	6.27	0.943	0.003250	7.92	0.956
Franco	0.004620	4.16	0.929	0.004080	5.46	0.945	0.003730	6.77	0.958
Franco limoso	0.005240	3.73	0.928	0.004510	5.11	0.943	0.004060	6.46	0.955
Franco-arcillo-arenoso	0.013620	1.52	0.927	0.011590	2.08	0.942	0.010360	2.68	0.954
Franco arenoso	0.025310	0.81	0.928	0.022670	1.03	0.945	0.021300	1.19	0.957

Cuadro 7.- Diseño de riego con el modelo de Saint Venant y Richards.

Textura del suelo	Lr = 8 cm			Lr = 10 cm			Lr = 12 cm		
	Q	Tr	CUC	Q	Tr	CUC	Q	Tr	CUC
	l/s/m²	(h)	-	l/s/m²	(h)	-	l/s/m²	(h)	-
Arcilla	0.000120	224.10		0.000100	338.20		0.000090	445.00	
Arcilla limosa	0.000140	201.60		0.000120	270.50		0.000110	362.50	
Franco-arcillo-limoso	0.000600	44.10		0.000500	66.60		0.000460	82.90	
Franco-arcilloso	0.000880	31.40		0.000780	44.00		0.000720	57.80	
Arcilla arenosa	0.000900	28.70		0.000800	42.40		0.000770	52.00	
Limo	0.003990	6.90		0.003330	10.00		0.002960	13.70	
Franco	0.004110	6.40		0.003540	9.60		0.003260	12.50	
Franco limoso	0.004460	6.20		0.003880	8.80		0.003490	11.60	
Franco-arcillo-arenoso	0.004900	5.80		0.004760	7.40		0.004640	9.00	
Franco arenoso	0.024760	1.20		0.022230	1.60		0.020730	2.00	

Cuadro 8.- Diferencia (%)

Textura del suelo	(%)		
Arcilla	154%	150%	133%
Arcilla limosa	117%	117%	109%
Franco-arcillo-limoso	65%	64%	59%
Franco-arcilloso	60%	58%	53%
Arcilla arenosa	66%	64%	55%
Limo	4%	8%	10%
Franco	12%	15%	14%
Franco limoso	17%	16%	16%
Franco-arcillo-arenoso	18%	7%	12%
Franco arenoso	2%	2%	3%
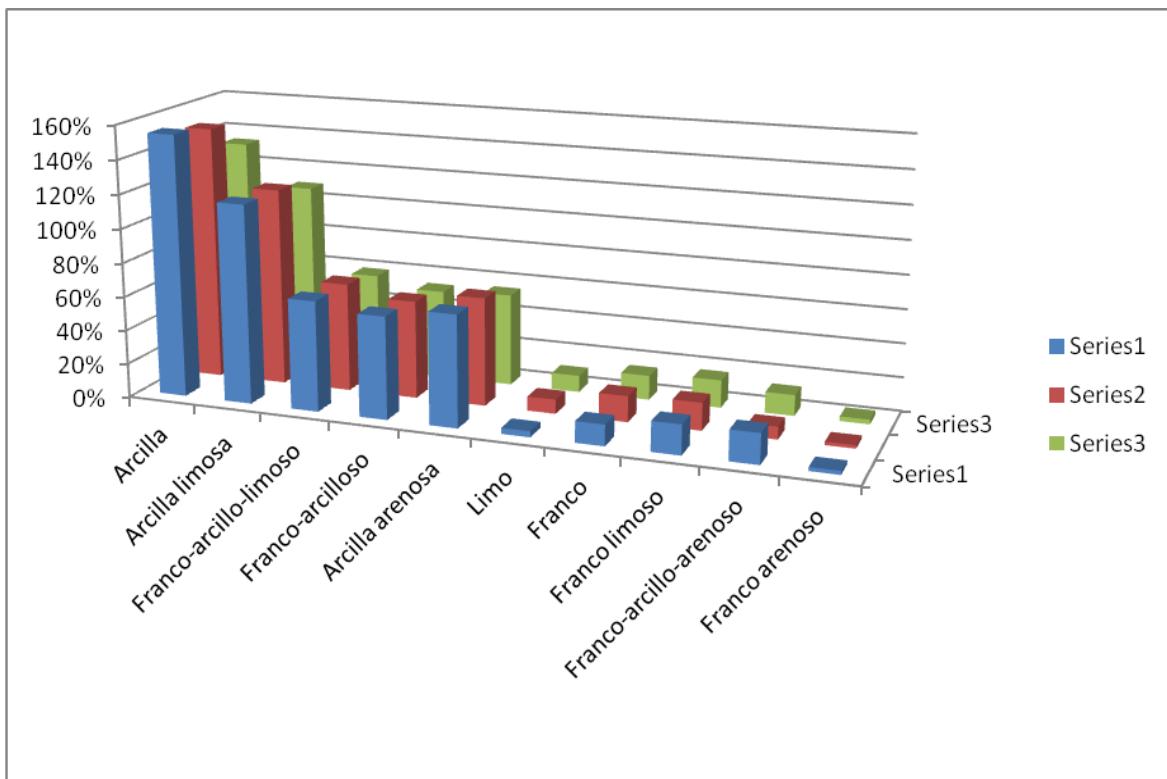
Ilustración 43.- Comparación.

3.4. Desarrollo y codificación de algoritmo para asignación de valores iniciales en proceso de optimización en programa de cómputo para diseño de riego por gravedad.

A) Código en C++ para asignación del valor inicial en proceso de optimización

A continuación se muestra el código en c ++ que permite asignar un valor inicial de Ks y hf en el proceso de optimización a partir de datos de una prueba de riego, por razones de espacio solo se muestra una parte del mismo:

```
void CERO::asigna()
{
double aux, ksini, hfini, posicion,dtheta;
  long int i,j;
  double a,b,c,a11,a12,a21,a22,b1,b2,maximojtj,
amortiguamiento, deltaks, deltahf;
  double controlecm,ECMact,ECMant;
  double *Tinicial, *Xinicial, *Tksplus, *Xksplus,
*Thfplus, *Xhfplus, *dfdks, *dfdhf, *simulado,
*observado;
  int contaLM;
  double tol1, res1;
  int     maxit, n;
//   double thetaS, thetacero;
  double incrementoks, incrementohf;
//   double C, S;
  double OM, thetas33t, thetas33, psit,
theta1500t, theta1500, theta33t, theta33, B,
lambda, thetas;
//      double Ks, hf;

  ifstream Lee;
        ofstream Escribe;

Escribe.open("c:\\Acople\\ECMSVGA.txt",ios::trun
c); Escribe.close();

//****************asignación de valores
característicos de la simulación**************

longitud=10000.;
lamina=10.;

pendiente=0.002;

indicalong=0;
nivelesriego=30000;
nivalmac=100000;//asignacion inicial al nivel de
tiempo en que termina el almacenamiento
nivelres=100000;//asignacion inicial al nivel de
tiempo en que empieza la recesion
//discretizacion

dtini=5.; dt=dtini;
//impresion
niveltimp=50; dtimp=50;
//gasto minimo para la recesion
//Qminres=Qcab/10.;
//Qminres=.01;//arenas
Qminres=.05;//arcilla

thetaS=0.4685;
thetacero=0.2749;

incrementoks=.1;
incrementohf=.5;

final=2;

//valores en la
frontera*******************************

Q1=Qcab;

//valores iniciales de los parametros

posicion=2000.; //primer intervalo de registro del
frente de avance

//primeros valores iniciales

C=.15; //relacion en peso arcilla/peso total
S=.45; //relacion peso arena/peso total
OM=1.5; //porcentaje de materia organica

thetas33t=0.278*S+0.034*C+.022*OM-
0.018*S*OM-0.027*C*OM-0.584*S*C+0.078;
thetas33=thetas33t+0.636*thetas33t-0.107;
psit=-21.67*S-27.93*C-
81.97*thetas33+71.12*S*thetas33+8.29*C*thetas
33+14.05*S*C+27.16;
hfini=psit+(0.02*psit*psit-0.113*psit-0.7);
hfini*=10.19744; //conversion de unidadesd e KPa
a cm de columna de agua
```

```
theta1500t=-
0.024*S+0.487*C+0.006*OM+0.005*S*OM-
0.013*C*OM+0.068*S*C+0.031;
theta1500=theta1500t+(0.14*theta1500t-0.02);
{

Avance(Ksv,Bsv);

if(nivelt>1) Choleskisv(incoest2);

//calculo de la lamina aplicada media
sumaL=0;
n=1;
for(i=1;i<=nincot;i++)
{
if (i/2<i/2.)
{
  sumaL+=(Rfin[n]+incoant[i]);
 n++;
  }
}
if(nivelt<=nivelesriego)laminaplicada=sumaL/nivelt
;
if(nivelt>=nivelesriego)laminaplicada=sumaL/nivel
esriego;


gotoxy(1,20);cout<<"
";
gotoxy(1,20);cout<<"Calculando la PRIMERA
curva de avance                    ";
gotoxy(1,23);cout<<"
";
gotoxy(1,23);cout<<"Lamina aplicada..."<<"
"<<laminaplicada<<"    "<<"lamina necesaria
"<<laminabruta;

if(nivelt==1)
{
res1=0.;
for (i=1;i<=ninco;i++)
{
if(incoest1[i]!=0.){
aux=fabs((incoest1[i]-incoest2[i])/incoest1[i]);
if (res1<aux) res1=aux;
}}
}else res1=0.;

if (nivelt==1)
{for(i=1;i<=ninco;i++){incoest1[i]=(incoest1[i]+inco
est2[i])/2.;}
}
```

```
if(contasv>maxit) break; contasv++;

}while(res1>tol1); //cierre tercer do, calculo de la
primera curva de avance

if(nivelt==1) Y[2]=incoest2[2];

if(nivelt<nivelesriego)
{
if (nivelt>1)
{
avanza[1]=incoant[1]+incoest2[1];
avanza[2]=Q1+incoest2[2];
for (i=3;i<=nincot-1;i++){avanza[i]=incoant[i-
2]+incoest2[i];}
avanza[nincot]=0.;
Y[nivelt+1]=2.*Y[nivelt]-Y[nivelt-
1]+incoest2[nincot];//asigna un valor para la malla
//if(Y[nivelt+1]>longitud && indicalong<1){
nivelesriego=nivelt+1; indicalong=1;}
}
}

if(nivelt==nivelesriego)
{
avanza[1]=incoant[1]+incoest2[1];
avanza[2]=Q1+incoest2[2];
for
(i=3;i<=nincot;i++){avanza[i]=incoant[i]+incoest2[i];
}
}

//Calculo de recargas con Green & Ampt

dtheta=thetaS-thetacero;

if (contaLM==1) {Ks=ksini; hf=hfini;}
if (contaLM>1) {Ks=ksplus; hf=hfplus;}

if(nivelt==1){Rfin[1]=Ks*dt+pow(pow(Ks*dt,2.)+po
w(Rini[1],2.)+Ks*dt*Rini[1]+dt*Ks*dtheta*(2.*hf+av
anza[1]+incoant[1]),.5);}

if(nivelt>1)
{
Rfin[1]=Ks*dt+Rini[1]+dt*Ks*dtheta*(hf+avanza[1]
+incoant[1])/Rini[1];
for(i=2;i<=nivelt-1;i++)
{
Rfin[i]=Ks*dt+Rini[i]+dt*Ks*dtheta*(hf+avanza[2*i-
1]+incoant[2*i-1])/Rini[i];
}
}
```

```
resrec=0.;

for(i=1;i<=nivelt;i++)
{aux=fabs(Rfin[i]-Rfina[i]);
if(resrec<aux) resrec=aux;}

for(i=1;i<=nnutod;i++) Rfina[i]=Rfin[i];

contaco++; if(contaco>5) break;

limiteresrec=.001;

}while(resrec>limiteresrec); //cierre segundo do,
calculo de la primera curva de avance


//asignacion de valores iniciales para el siguiente
nivel de tiempo
if
(nivelt==1){incoant[1]=incoest2[1];incoant[2]=inco
est2[2];Y[2]=incoest2[2];}
if(nivelt>1)for
(i=1;i<=nincot;i++){incoant[i]=avanza[i];}
for (i=1;i<=nivelt;i++){Rini[i]=Rfin[i];}

Tinicial[nivelt]=(tiem-dt);
Xinicial[nivelt]=Y[nivelt];

//CALCULO DE LA SEGUNDA CURVA DE
AVANCE

Inicio();
Iniciosv();

nivelt=1;

do  //primer do, calculo de la SEGUNDA curva de
avance
{
if (nivelt==1) tiem=dt;
if (nivelt>1) tiem+=dt;

contaco=1;

do // segundo do, calculo de la SEGUNDA curva
de avance
{

tol1=.001; maxit=500; contasv=1;

do // tercer do, calculo de la SEGUNDA curva de
avance
```

```
{
//calculo de la lamina aplicada media
sumaL=0;
n=1;
for(i=1;i<=nincot;i++)
{
if (i/2<i/2.)
{
  sumaL+=(Rfin[n]+incoant[i]);
 n++;
  }
}
if(nivelt<=nivelesriego)laminaplicada=sumaL/nivelt
;
if(nivelt>=nivelesriego)laminaplicada=sumaL/nivel
esriego;


gotoxy(1,20);cout<<"
";

if(nivelt==1)
{
res1=0.;
for (i=1;i<=ninco;i++)
{
if(incoest1[i]!=0.){
aux=fabs((incoest1[i]-incoest2[i])/incoest1[i]);
if (res1<aux) res1=aux;
}}
}else res1=0.;

if (nivelt==1)
{for(i=1;i<=ninco;i++){incoest1[i]=(incoest1[i]+inco
est2[i])/2.;}
}

if(contasv>maxit) break; contasv++;

}while(res1>tol1); //cierre tercer do, calculo de la
SEGUNDA curva de avance

if(nivelt==1) Y[2]=incoest2[2];

if(nivelt<nivelesriego)
{
if (nivelt>1)
{
avanza[1]=incoant[1]+incoest2[1];
avanza[2]=Q1+incoest2[2];
for (i=3;i<=nincot-1;i++){avanza[i]=incoant[i-
2]+incoest2[i];}
avanza[nincot]=0.;
```

```
Y[nivelt+1]=2.*Y[nivelt]-Y[nivelt-
1]+incoest2[nincot];//asigna un valor para la malla
//if(Y[nivelt+1]>longitud && indicalong<1){
nivelesriego=nivelt+1; indicalong=1;}
}
}

if(nivelt==nivelesriego)
{
avanza[1]=incoant[1]+incoest2[1];
avanza[2]=Q1+incoest2[2];
for
(i=3;i<=nincot;i++){avanza[i]=incoant[i]+incoest2[i];
}
}

//Calculo de recargas con Green & Ampt

dtheta=thetaS-thetacero;

if (contaLM==1) {Ks=ksini*(1+incrementoks);
hf=hfini;}
if (contaLM>1) {Ks=ksplus*(1+incrementoks);
hf=hfplus;}

if(nivelt==1){Rfin[1]=Ks*dt+pow(pow(Ks*dt,2.)+po
w(Rini[1],2.)+Ks*dt*Rini[1]+dt*Ks*dtheta*(2.*hf+av
anza[1]+incoant[1]),.5);}

if(nivelt>1)
{
Rfin[1]=Ks*dt+Rini[1]+dt*Ks*dtheta*(hf+avanza[1]
+incoant[1])/Rini[1];
for(i=2;i<=nivelt-1;i++)
{
Rfin[i]=Ks*dt+Rini[i]+dt*Ks*dtheta*(hf+avanza[2*i-
1]+incoant[2*i-1])/Rini[i];
}
}

resrec=0.;

for(i=1;i<=nivelt;i++)
{aux=fabs(Rfin[i]-Rfina[i]);
if(resrec<aux) resrec=aux;}

for(i=1;i<=nnutod;i++) Rfina[i]=Rfin[i];

contaco++; if(contaco>5) break;

limiteresrec=.001;
}
```

```
//asignacion de valores iniciales para el siguiente
nivel de tiempo
if
(nivelt==1){incoant[1]=incoest2[1];incoant[2]=inco
est2[2];Y[2]=incoest2[2];}
if(nivelt>1)for
(i=1;i<=nincot;i++){incoant[i]=avanza[i];}
for (i=1;i<=nivelt;i++){Rini[i]=Rfin[i];}

Tksplus[nivelt]=(tiem-dt);
Xksplus[nivelt]=Y[nivelt];

Archivar();

nivelt++;

gotoxy(1,22);cout<<"
"<<endl;
gotoxy(1,22);cout<<"Time   "<<tiem<<"  "<<"dt
"<<dt<<"  "<<"frente   "<<Y[nivelt]<<endl;

}while (Y[nivelt-1]<=longitud);//cierre primer do,
calculo de la SEGUNDA curva de avance

//CALCULO DE LA TERCERA CURVA DE
AVANCE

Inicio();
Iniciosv();

nivelt=1;

do //primer do, calculo de la TERCERA curva de
avance
{
if (nivelt==1) tiem=dt;
if (nivelt>1) tiem+=dt;

contaco=1;

do // segundo do, calculo de la TERCERA curva
de avance
{

tol1=.001; maxit=500; contasv=1;

do // tercer do, calculo de la TERCERA curva de
avance
{

Avance(Ksv,Bsv);
```

```
if(nivelt>1) Choleskisv(incoest2);

//calculo de la lamina aplicada media
sumaL=0;
n=1;
for(i=1;i<=nincot;i++)
{
if (i/2<i/2.)
{
 sumaL+=(Rfin[n]+incoant[i]);
 n++;
 }
}
if(nivelt<=nivelesriego)laminaplicada=sumaL/nivelt
;
if(nivelt>=nivelesriego)laminaplicada=sumaL/nivel
esriego;


gotoxy(1,20);cout<<"
";
gotoxy(1,20);cout<<"Calculando la TERCERA
curva de avance                    ";
gotoxy(1,23);cout<<"
";
gotoxy(1,23);cout<<"Lamina aplicada..."<<"
"<<laminaplicada<<"    "<<"lamina necesaria
"<<laminabruta;

if(nivelt==1)
{
res1=0.;
for (i=1;i<=ninco;i++)
{
if(incoest1[i]!=0.){
aux=fabs((incoest1[i]-incoest2[i])/incoest1[i]);
if (res1<aux) res1=aux;
}}
}else res1=0.;

if (nivelt==1)
{for(i=1;i<=ninco;i++){incoest1[i]=(incoest1[i]+inco
est2[i])/2.;}
}

if(contasv>maxit) break; contasv++;

}while(res1>tol1); //cierre tercer do, calculo de la
TERCERA curva de avance

if(nivelt==1) Y[2]=incoest2[2];

if(nivelt<nivelesriego)
```

```
{
if (nivelt>1)
{
avanza[1]=incoant[1]+incoest2[1];
avanza[2]=Q1+incoest2[2];
for (i=3;i<=nincot-1;i++){avanza[i]=incoant[i-
2]+incoest2[i];}
avanza[nincot]=0.;
Y[nivelt+1]=2.*Y[nivelt]-Y[nivelt-
1]+incoest2[nincot];//asigna un valor para la malla
//if(Y[nivelt+1]>longitud && indicalong<1){
nivelesriego=nivelt+1; indicalong=1;}
}
}

if(nivelt==nivelesriego)
{
avanza[1]=incoant[1]+incoest2[1];
avanza[2]=Q1+incoest2[2];
for
(i=3;i<=nincot;i++){avanza[i]=incoant[i]+incoest2[i];
}
}

//Calculo de recargas con Green & Ampt

dtheta=thetaS-thetacero;

if (contaLM==1) {Ks=ksini;
hf=hfini*(1+incrementohf);}
if (contaLM>1) {Ks=ksplus;
hf=hfplus*(1+incrementohf);}

if(nivelt==1){Rfin[1]=Ks*dt+pow(pow(Ks*dt,2.)+po
w(Rini[1],2.)+Ks*dt*Rini[1]+dt*Ks*dtheta*(2.*hf+av
anza[1]+incoant[1]),.5);}

if(nivelt>1)
{
Rfin[1]=Ks*dt+Rini[1]+dt*Ks*dtheta*(hf+avanza[1]
+incoant[1])/Rini[1];
for(i=2;i<=nivelt-1;i++)
{
Rfin[i]=Ks*dt+Rini[i]+dt*Ks*dtheta*(hf+avanza[2*i-
1]+incoant[2*i-1])/Rini[i];
}
}

resrec=0.;

for(i=1;i<=nivelt;i++)
{aux=fabs(Rfin[i]-Rfina[i]);
if(resrec<aux) resrec=aux;}
```

```
for(i=1;i<=nnutod;i++) Rfina[i]=Rfin[i];

contaco++; if(contaco>5) break;

limiteresrec=.001;

Thfplus[nivelt]=tiem;
Xhfplus[nivelt]=Y[nivelt];

Archivar();

nivelt++;

gotoxy(1,22);cout<<"
"<<endl;
gotoxy(1,22);cout<<"Time   "<<tiem<<"   "<<"dt
"<<dt<<"   "<<"frente   "<<Y[nivelt]<<endl;


}while (Y[nivelt-1]<=longitud);//cierre primer do,
cálculo de la TERCERA curva de avance


for (j=1;j<=5;j++)
{
for (i=1;i<=nivelesriego;i++)
{
if (Xinicial[i]>=posicion) {a=Tinicial[i-1]; break;}
}

for (i=1;i<=nivelesriego;i++)
{
if (Xksplus[i]>=posicion)  {b=Tksplus[i-1]; break;}
}

for (i=1;i<=nivelesriego;i++)
{
if (Xhfplus[i]>=posicion)  {c=Thfplus[i-1]; break;}
}

posicion+=2000.;

if (contaLM==1) {dfdks[j]=(b-
a)/(incrementoks*ksini*3600.);}
if (contaLM>1)  {dfdks[j]=(b-
a)/(incrementoks*ksplus*3600.);}

if (contaLM==1) {dfdhf[j]=(c-
a)/(incrementohf*hfini);}
if (contaLM>1)  {dfdhf[j]=(c-
a)/(incrementohf*hfplus);}
```

```
}

aux=0.;

for (j=1;j<=5;j++)
{
aux+=dfdhf[j]*dfdhf[j];
}
a11=aux;

aux=0.;

for (j=1;j<=5;j++)
{
aux+=dfdhf[j]*dfdks[j];
}
a12=aux;
```
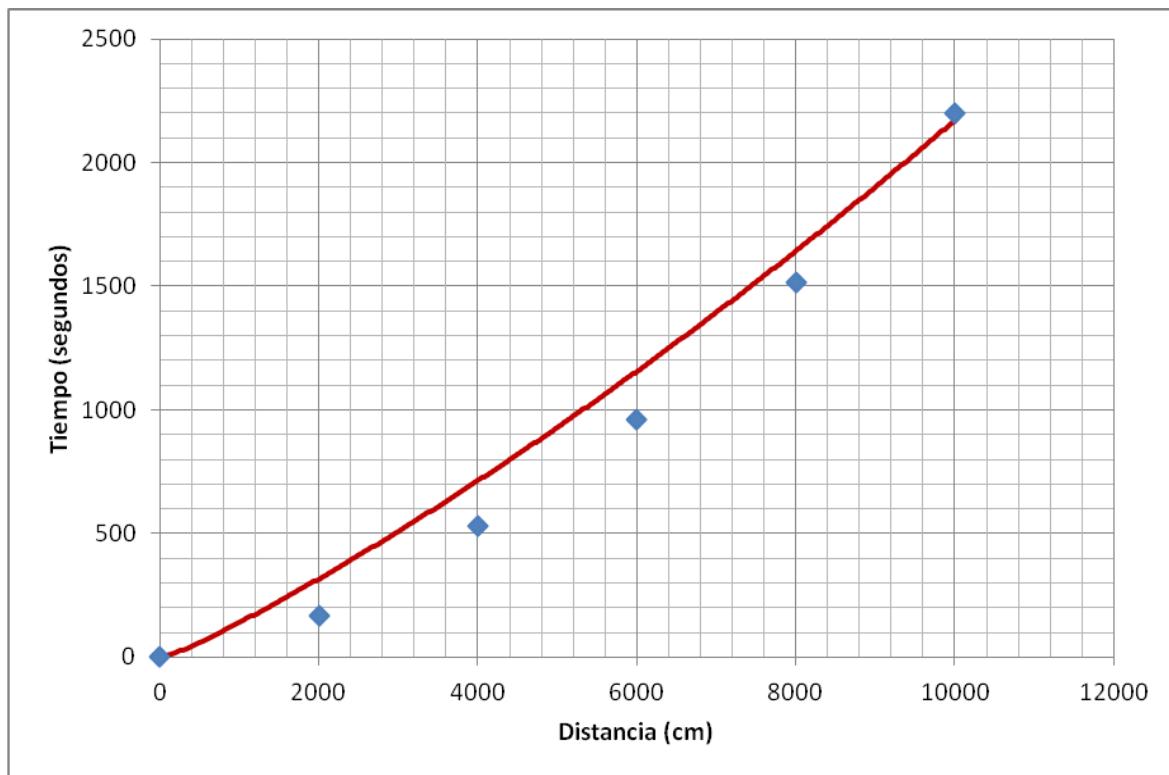
B) Aplicación para tres tipos de suelos contrastantes

Se verifica que el proceso de asignación de valores iniciales funcione bien para tres tipos de suelos contrastantes: limo, arcilla y franco arenoso. A continuación se muestran los resultados correspondientes:

Suelo Arcilla

Ilustración 44.- Iteración 1 de Levenberg-Marquardt para Suelo Arcilla.

Tabla 1. Primera iteración Levenberg-Marquardt para suelo arcilla.

Iteración Levenberg-Marquardt 1					Iteración Levenberg-Marquardt 1					Iteración Levenberg-Marquardt 1				
0	0	0	0	0	430.558	50	1.29014	0.193683	9.62965	754.306	100	1.35371	0.271953	9.83531
78.0939	5	0.757746	0.0580004	78.0939	464.407	55	1.30105	0.20289	9.66884	785.332	105	1.3568	0.27857	9.84414
139.205	10	0.971007	0.0879182	6.51536	497.763	60	1.31042	0.211691	9.70115	816.176	110	1.35957	0.285034	9.85204
182.951	15	1.08062	0.107822	8.16657	530.815	65	1.31853	0.220134	9.72806	846.848	115	1.36207	0.291356	9.85913
214.541	20	1.14744	0.124132	8.77722	563.562	70	1.3256	0.228262	9.75076	877.356	120	1.36432	0.297544	9.86551
251.866	25	1.19087	0.138347	9.11378	595.986	75	1.33181	0.236108	9.77015	907.71	125	1.36637	0.303608	9.87129
290.418	30	1.22112	0.151134	9.3127	628.122	80	1.33728	0.2437	9.78688	937.917	130	1.36822	0.309554	9.87652
326.623	35	1.2439	0.162863	9.43671	660.008	85	1.34213	0.251061	9.80142	967.983	135	1.36991	0.315389	9.88128
361.349	40	1.26216	0.173767	9.52008	691.659	90	1.34644	0.258213	9.81416	997.916	140	1.37144	0.32112	9.88562
396.087	45	1.27734	0.184003	9.58141	723.087	95	1.35028	0.265172	9.82537	1027.72	145	1.37284	0.326751	9.88959

Iteración Levenberg-Marquardt 1				
1057.4	150	1.37412	0.332289	9.89324
1086.96	155	1.37529	0.337737	9.89658
1116.41	160	1.37637	0.343099	9.89967
1145.75	165	1.37735	0.348381	9.90252
1174.98	170	1.37826	0.353585	9.90516
1204.11	175	1.3791	0.358715	9.90761
1233.14	180	1.37987	0.363774	9.90988
1262.07	185	1.38058	0.368765	9.912
1290.91	190	1.38124	0.373691	9.91398
1319.66	195	1.38185	0.378554	9.91582
1348.32	200	1.38242	0.383357	9.91756
1376.89	205	1.38294	0.388102	9.91918
1405.38	210	1.38343	0.39279	9.92071
1433.79	215	1.38389	0.397425	9.92214
1462.11	220	1.38431	0.402008	9.9235
1490.36	225	1.38471	0.40654	9.92478
1518.53	230	1.38509	0.411023	9.92599
1546.63	235	1.38544	0.41546	9.92714
1574.65	240	1.38576	0.41985	9.92823
1602.6	245	1.38607	0.424197	9.92926
1630.49	250	1.38636	0.428501	9.93025
1658.3	255	1.38663	0.432763	9.93119
1686.04	260	1.38689	0.436984	9.93208
1713.71	265	1.38714	0.441167	9.93294
1741.32	270	1.38737	0.445311	9.93376
1768.87	275	1.38758	0.449419	9.93454
1796.35	280	1.38779	0.45349	9.93529
1823.77	285	1.38799	0.457526	9.93601
1851.13	290	1.38818	0.461528	9.93671
1878.42	295	1.38835	0.465497	9.93738
1905.66	300	1.38852	0.469433	9.93802
1932.84	305	1.38869	0.473338	9.93864
1959.96	310	1.38884	0.477211	9.93923
1987.02	315	1.38899	0.481055	9.93981
2014.02	320	1.38913	0.484869	9.94037
2040.97	325	1.38927	0.488655	9.94091
2067.87	330	1.3894	0.492412	9.94143

Iteración Levenberg-Marquardt 1				
2094.7	335	1.38953	0.496142	9.94194
2121.49	340	1.38965	0.499845	9.94243
2148.22	345	1.38976	0.503522	9.94291
2174.9	350	1.38988	0.507173	9.94337
2201.52	355	1.38999	0.510799	9.94382
2228.1	360	1.39009	0.514401	9.94426
2254.62	365	1.39019	0.517978	9.94468
2281.1	370	1.39029	0.521532	9.9451
2307.52	375	1.39038	0.525062	9.9455
2333.89	380	1.39048	0.52857	9.94589
2360.22	385	1.39057	0.532056	9.94628
2386.49	390	1.39065	0.53552	9.94665
2412.72	395	1.39074	0.538963	9.94702
2438.9	400	1.39082	0.542384	9.94738
2465.03	405	1.3909	0.545785	9.94773
2491.12	410	1.39097	0.549166	9.94807
2517.16	415	1.39105	0.552527	9.9484
2543.15	420	1.39112	0.555869	9.94873
2569.1	425	1.39119	0.559191	9.94905
2595.01	430	1.39126	0.562495	9.94936
2620.87	435	1.39133	0.56578	9.94967
2646.68	440	1.3914	0.569047	9.94997
2672.45	445	1.39146	0.572296	9.95026
2698.18	450	1.39153	0.575528	9.95055
2723.86	455	1.39159	0.578743	9.95084
2749.5	460	1.39165	0.58194	9.95112
2775.1	465	1.39171	0.585121	9.95139
2800.66	470	1.39177	0.588285	9.95166
2826.17	475	1.39182	0.591433	9.95192
2851.64	480	1.39188	0.594566	9.95218
2877.08	485	1.39194	0.597682	9.95243
2902.47	490	1.39199	0.600784	9.95268
2927.82	495	1.39204	0.60387	9.95293
2953.12	500	1.39209	0.606941	9.95317
2978.39	505	1.39214	0.609997	9.95341
3003.62	510	1.39219	0.613039	9.95364
3028.81	515	1.39224	0.616067	9.95387

Iteración Levenberg-Marquardt 1				
3053.96	520	1.39229	0.61908	9.9541
3079.08	525	1.39234	0.62208	9.95432
3104.15	530	1.39238	0.625065	9.95454
3129.18	535	1.39243	0.628038	9.95475
3154.18	540	1.39247	0.630997	9.95497
3179.14	545	1.39252	0.633943	9.95518
3204.06	550	1.39256	0.636876	9.95538
3228.94	555	1.3926	0.639796	9.95559
3253.79	560	1.39265	0.642704	9.95579
3278.59	565	1.39269	0.645599	9.95598
3303.37	570	1.39273	0.648482	9.95618
3328.1	575	1.39277	0.651353	9.95637
3352.8	580	1.39281	0.654212	9.95656
3377.46	585	1.39285	0.657059	9.95675
3402.09	590	1.39289	0.659894	9.95693
3426.68	595	1.39292	0.662718	9.95711
3451.24	600	1.39296	0.665531	9.95729
3475.76	605	1.393	0.668332	9.95747
3500.25	610	1.39303	0.671122	9.95764
3524.7	615	1.39307	0.673902	9.95782
3549.11	620	1.3931	0.67667	9.95799
3573.5	625	1.39314	0.679428	9.95815
3597.84	630	1.39317	0.682175	9.95832
3622.16	635	1.39321	0.684912	9.95848
3646.44	640	1.39324	0.687639	9.95864
3670.68	645	1.39327	0.690355	9.9588
3694.9	650	1.39331	0.693062	9.95896
3719.08	655	1.39334	0.695758	9.95912
3743.22	660	1.39337	0.698445	9.95927
3767.34	665	1.3934	0.701122	9.95942
3791.42	670	1.39343	0.703789	9.95958
3815.47	675	1.39346	0.706447	9.95972
3839.48	680	1.39349	0.709095	9.95987
3863.47	685	1.39352	0.711734	9.96002
3887.42	690	1.39355	0.714364	9.96016
3911.34	695	1.39358	0.716985	9.9603
3935.23	700	1.39361	0.719597	9.96044

Iteración Levenberg-Marquardt 1				
3959.09	705	1.39364	0.7222	9.96058
3982.91	710	1.39367	0.724794	9.96072
4006.71	715	1.39369	0.727379	9.96085
4030.47	720	1.39372	0.729956	9.96099
4054.2	725	1.39375	0.732524	9.96112
4077.91	730	1.39378	0.735084	9.96125
4101.58	735	1.3938	0.737635	9.96138
4125.22	740	1.39383	0.740178	9.96151
4148.83	745	1.39385	0.742713	9.96164
4172.41	750	1.39388	0.74524	9.96177
4195.96	755	1.39391	0.747759	9.96189
4219.48	760	1.39393	0.75027	9.96201
4242.97	765	1.39396	0.752773	9.96214
4266.43	770	1.39398	0.755268	9.96226
4289.86	775	1.394	0.757756	9.96238
4313.27	780	1.39403	0.760236	9.9625
4336.64	785	1.39405	0.762708	9.96261
4359.99	790	1.39408	0.765173	9.96273
4383.3	795	1.3941	0.76763	9.96284
4406.59	800	1.39412	0.77008	9.96296
4429.85	805	1.39415	0.772523	9.96307
4453.08	810	1.39417	0.774958	9.96318
4476.28	815	1.39419	0.777387	9.96329
4499.45	820	1.39421	0.779808	9.9634
4522.6	825	1.39424	0.782222	9.96351
4545.72	830	1.39426	0.78463	9.96362
4568.81	835	1.39428	0.78703	9.96373
4591.87	840	1.3943	0.789423	9.96383
4614.91	845	1.39432	0.79181	9.96394
4637.91	850	1.39434	0.79419	9.96404
4660.89	855	1.39436	0.796564	9.96414
4683.85	860	1.39438	0.798931	9.96424
4706.77	865	1.3944	0.801291	9.96435
4729.67	870	1.39442	0.803645	9.96445
4752.54	875	1.39444	0.805992	9.96455
4775.39	880	1.39446	0.808333	9.96464
4798.21	885	1.39448	0.810668	9.96474

Iteración Levenberg-Marquardt 1				
4821	890	1.3945	0.812996	9.96484
4843.76	895	1.39452	0.815318	9.96493
4866.5	900	1.39454	0.817634	9.96503
4889.22	905	1.39456	0.819944	9.96512
4911.9	910	1.39458	0.822248	9.96522
4934.57	915	1.3946	0.824546	9.96531
4957.2	920	1.39462	0.826838	9.9654
4979.81	925	1.39464	0.829124	9.96549
5002.4	930	1.39465	0.831404	9.96558
5024.95	935	1.39467	0.833678	9.96567
5047.49	940	1.39469	0.835947	9.96576
5070	945	1.39471	0.83821	9.96585
5092.48	950	1.39472	0.840467	9.96594
5114.94	955	1.39474	0.842719	9.96602
5137.37	960	1.39476	0.844964	9.96611
5159.78	965	1.39478	0.847205	9.96619
5182.16	970	1.39479	0.84944	9.96628
5204.52	975	1.39481	0.851669	9.96636
5226.85	980	1.39483	0.853893	9.96644
5249.16	985	1.39484	0.856112	9.96653
5271.45	990	1.39486	0.858325	9.96661
5293.71	995	1.39488	0.860533	9.96669
5315.94	1000	1.39489	0.862736	9.96677
5338.15	1005	1.39491	0.864933	9.96685
5360.34	1010	1.39492	0.867126	9.96693
5382.51	1015	1.39494	0.869313	9.96701
5404.65	1020	1.39496	0.871495	9.96709
5426.76	1025	1.39497	0.873672	9.96717
5448.86	1030	1.39499	0.875844	9.96724
5470.93	1035	1.395	0.878011	9.96732
5492.97	1040	1.39502	0.880173	9.9674
5514.99	1045	1.39503	0.88233	9.96747
5536.99	1050	1.39505	0.884483	9.96755
5558.97	1055	1.39506	0.88663	9.96762
5580.92	1060	1.39508	0.888773	9.96769
5602.85	1065	1.39509	0.89091	9.96777
5624.76	1070	1.39511	0.893043	9.96784

Iteración Levenberg-Marquardt 1				
5646.64	1075	1.39512	0.895172	9.96791
5668.5	1080	1.39514	0.897295	9.96798
5690.34	1085	1.39515	0.899414	9.96806
5712.16	1090	1.39516	0.901529	9.96813
5733.95	1095	1.39518	0.903639	9.9682
5755.72	1100	1.39519	0.905744	9.96827
5777.47	1105	1.39521	0.907845	9.96834
5799.2	1110	1.39522	0.909941	9.9684
5820.9	1115	1.39523	0.912033	9.96847
5842.58	1120	1.39525	0.91412	9.96854
5864.24	1125	1.39526	0.916203	9.96861
5885.88	1130	1.39527	0.918282	9.96867
5907.49	1135	1.39529	0.920356	9.96874
5929.09	1140	1.3953	0.922426	9.96881
5950.66	1145	1.39531	0.924491	9.96887
5972.21	1150	1.39533	0.926553	9.96894
5993.74	1155	1.39534	0.92861	9.969
6015.25	1160	1.39535	0.930663	9.96907
6036.73	1165	1.39536	0.932712	9.96913
6058.2	1170	1.39538	0.934756	9.96919
6079.64	1175	1.39539	0.936797	9.96926
6101.06	1180	1.3954	0.938833	9.96932
6122.46	1185	1.39541	0.940866	9.96938
6143.84	1190	1.39543	0.942894	9.96944
6165.2	1195	1.39544	0.944918	9.9695
6186.54	1200	1.39545	0.946938	9.96957
6207.85	1205	1.39546	0.948955	9.96963
6229.15	1210	1.39548	0.950967	9.96969
6250.42	1215	1.39549	0.952975	9.96975
6271.68	1220	1.3955	0.95498	9.96981
6292.91	1225	1.39551	0.956981	9.96987
6314.12	1230	1.39552	0.958977	9.96992
6335.32	1235	1.39553	0.96097	9.96998
6356.49	1240	1.39555	0.96296	9.97004
6377.64	1245	1.39556	0.964945	9.9701
6398.77	1250	1.39557	0.966927	9.97016
6419.88	1255	1.39558	0.968904	9.97021
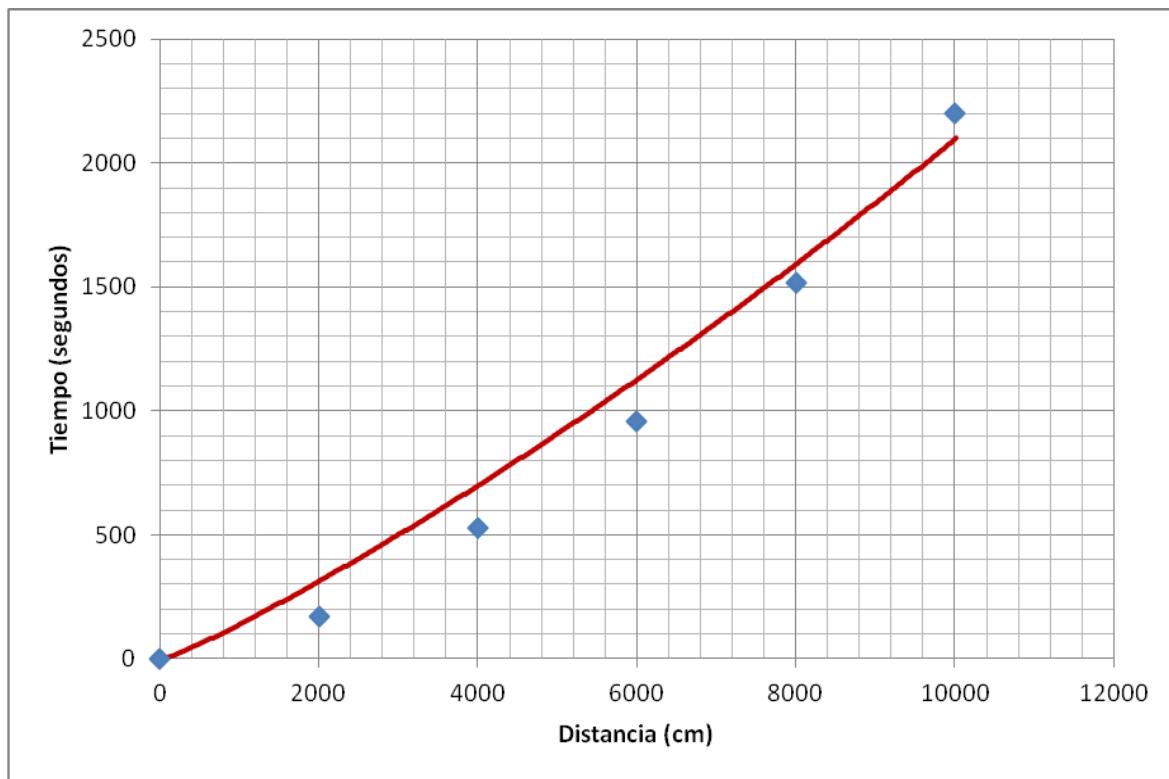
Iteración Levenberg-Marquardt 1				
6440.98	1260	1.39559	0.970879	9.97027
6462.05	1265	1.3956	0.972849	9.97033
6483.1	1270	1.39561	0.974816	9.97038
6504.13	1275	1.39563	0.976779	9.97044
6525.14	1280	1.39564	0.978739	9.97049
6546.13	1285	1.39565	0.980695	9.97055
6567.1	1290	1.39566	0.982647	9.9706
6588.06	1295	1.39567	0.984596	9.97066
6608.99	1300	1.39568	0.986541	9.97071
6629.9	1305	1.39569	0.988483	9.97076
6650.79	1310	1.3957	0.990421	9.97082
6671.67	1315	1.39571	0.992356	9.97087
6692.52	1320	1.39572	0.994287	9.97092
6713.36	1325	1.39573	0.996215	9.97098
6734.17	1330	1.39574	0.99814	9.97103
6754.97	1335	1.39575	1.00006	9.97108
6775.75	1340	1.39576	1.00198	9.97113
6796.51	1345	1.39577	1.00389	9.97118
6817.25	1350	1.39578	1.0058	9.97123
6837.97	1355	1.39579	1.00771	9.97128
6858.67	1360	1.3958	1.00962	9.97133
6879.35	1365	1.39581	1.01152	9.97138
6900.01	1370	1.39582	1.01341	9.97143
6920.66	1375	1.39583	1.01531	9.97148
6941.29	1380	1.39584	1.0172	9.97153
6961.89	1385	1.39585	1.01909	9.97158
6982.48	1390	1.39586	1.02097	9.97163
7003.05	1395	1.39587	1.02285	9.97168
7023.61	1400	1.39588	1.02473	9.97173
7044.14	1405	1.39589	1.02661	9.97177
7064.65	1410	1.3959	1.02848	9.97182
7085.15	1415	1.39591	1.03035	9.97187
7105.63	1420	1.39592	1.03222	9.97192
7126.09	1425	1.39593	1.03408	9.97196
7146.53	1430	1.39594	1.03594	9.97201
7166.96	1435	1.39595	1.03779	9.97206
7187.36	1440	1.39596	1.03965	9.9721

Iteración Levenberg-Marquardt 1				
7207.75	1445	1.39597	1.0415	9.97215
7228.12	1450	1.39597	1.04335	9.9722
7248.48	1455	1.39598	1.04519	9.97224
7268.81	1460	1.39599	1.04703	9.97229
7289.13	1465	1.396	1.04887	9.97233
7309.43	1470	1.39601	1.05071	9.97238
7329.71	1475	1.39602	1.05254	9.97242
7349.97	1480	1.39603	1.05437	9.97246
7370.22	1485	1.39604	1.0562	9.97251
7390.45	1490	1.39605	1.05802	9.97255
7410.66	1495	1.39605	1.05984	9.9726
7430.85	1500	1.39606	1.06166	9.97264
7451.03	1505	1.39607	1.06348	9.97268
7471.19	1510	1.39608	1.06529	9.97273
7491.33	1515	1.39609	1.0671	9.97277
7511.45	1520	1.3961	1.06891	9.97281
7531.56	1525	1.3961	1.07071	9.97285
7551.65	1530	1.39611	1.07251	9.97289
7571.72	1535	1.39612	1.07431	9.97294
7591.78	1540	1.39613	1.07611	9.97298
7611.82	1545	1.39614	1.0779	9.97302
7631.84	1550	1.39615	1.07969	9.97306
7651.85	1555	1.39615	1.08148	9.9731
7671.84	1560	1.39616	1.08327	9.97314
7691.81	1565	1.39617	1.08505	9.97318
7711.76	1570	1.39618	1.08683	9.97322
7731.7	1575	1.39619	1.08861	9.97326
7751.62	1580	1.39619	1.09038	9.9733
7771.53	1585	1.3962	1.09215	9.97334
7791.41	1590	1.39621	1.09392	9.97338
7811.29	1595	1.39622	1.09569	9.97342
7831.14	1600	1.39623	1.09745	9.97346
7850.98	1605	1.39623	1.09921	9.9735
7870.8	1610	1.39624	1.10097	9.97354
7890.61	1615	1.39625	1.10273	9.97358
7910.4	1620	1.39626	1.10448	9.97362
7930.17	1625	1.39626	1.10624	9.97366

Iteración Levenberg-Marquardt 1				
7949.93	1630	1.39627	1.10798	9.9737
7969.67	1635	1.39628	1.10973	9.97373
7989.39	1640	1.39629	1.11147	9.97377
8009.1	1645	1.39629	1.11322	9.97381
8028.8	1650	1.3963	1.11495	9.97385
8048.47	1655	1.39631	1.11669	9.97388
8068.13	1660	1.39632	1.11843	9.97392
8087.78	1665	1.39632	1.12016	9.97396
8107.41	1670	1.39633	1.12189	9.97399
8127.02	1675	1.39634	1.12361	9.97403
8146.62	1680	1.39635	1.12534	9.97407
8166.2	1685	1.39635	1.12706	9.9741
8185.76	1690	1.39636	1.12878	9.97414
8205.31	1695	1.39637	1.1305	9.97418
8224.85	1700	1.39637	1.13221	9.97421
8244.36	1705	1.39638	1.13392	9.97425
8263.87	1710	1.39639	1.13563	9.97428
8283.36	1715	1.39639	1.13734	9.97432
8302.83	1720	1.3964	1.13905	9.97435
8322.28	1725	1.39641	1.14075	9.97439
8341.72	1730	1.39642	1.14245	9.97442
8361.15	1735	1.39642	1.14415	9.97446
8380.56	1740	1.39643	1.14584	9.97449
8399.96	1745	1.39644	1.14754	9.97453
8419.34	1750	1.39644	1.14923	9.97456
8438.7	1755	1.39645	1.15092	9.9746
8458.05	1760	1.39646	1.15261	9.97463
8477.38	1765	1.39646	1.15429	9.97466
8496.7	1770	1.39647	1.15597	9.9747
8516.01	1775	1.39648	1.15765	9.97473
8535.3	1780	1.39648	1.15933	9.97477
8554.57	1785	1.39649	1.16101	9.9748
8573.83	1790	1.3965	1.16268	9.97483
8593.07	1795	1.3965	1.16435	9.97486
8612.3	1800	1.39651	1.16602	9.9749
8631.52	1805	1.39652	1.16769	9.97493
8650.72	1810	1.39652	1.16936	9.97496

Iteración Levenberg-Marquardt 1				
8669.9	1815	1.39653	1.17102	9.975
8689.07	1820	1.39653	1.17268	9.97503
8708.23	1825	1.39654	1.17434	9.97506
8727.37	1830	1.39655	1.176	9.97509
8746.49	1835	1.39655	1.17765	9.97512
8765.6	1840	1.39656	1.1793	9.97516
8784.7	1845	1.39657	1.18095	9.97519
8803.78	1850	1.39657	1.1826	9.97522
8822.85	1855	1.39658	1.18425	9.97525
8841.9	1860	1.39658	1.18589	9.97528
8860.94	1865	1.39659	1.18753	9.97531
8879.97	1870	1.3966	1.18918	9.97534
8898.98	1875	1.3966	1.19081	9.97537
8917.97	1880	1.39661	1.19245	9.97541
8936.95	1885	1.39662	1.19408	9.97544
8955.92	1890	1.39662	1.19571	9.97547
8974.87	1895	1.39663	1.19734	9.9755
8993.81	1900	1.39663	1.19897	9.97553
9012.74	1905	1.39664	1.2006	9.97556
9031.65	1910	1.39665	1.20222	9.97559
9050.54	1915	1.39665	1.20384	9.97562
9069.43	1920	1.39666	1.20546	9.97565
9088.29	1925	1.39666	1.20708	9.97568
9107.15	1930	1.39667	1.2087	9.97571
9125.99	1935	1.39667	1.21031	9.97574
9144.81	1940	1.39668	1.21193	9.97577
9163.63	1945	1.39669	1.21354	9.97579
9182.43	1950	1.39669	1.21514	9.97582
9201.21	1955	1.3967	1.21675	9.97585
9219.98	1960	1.3967	1.21835	9.97588
9238.74	1965	1.39671	1.21996	9.97591
9257.48	1970	1.39671	1.22156	9.97594
9276.21	1975	1.39672	1.22316	9.97597
9294.93	1980	1.39673	1.22475	9.976
9313.63	1985	1.39673	1.22635	9.97602
9332.32	1990	1.39674	1.22794	9.97605
9350.99	1995	1.39674	1.22953	9.97608
9369.65	2000	1.39675	1.23112	9.97611
9388.3	2005	1.39675	1.23271	9.97614
9406.94	2010	1.39676	1.2343	9.97616
9425.56	2015	1.39676	1.23588	9.97619
9444.17	2020	1.39677	1.23746	9.97622
9462.76	2025	1.39678	1.23904	9.97625
9481.34	2030	1.39678	1.24062	9.97627
9499.91	2035	1.39679	1.2422	9.9763
9518.46	2040	1.39679	1.24377	9.97633

Iteración Levenberg-Marquardt 1				
9537	2045	1.3968	1.24535	9.97636
9555.53	2050	1.3968	1.24692	9.97638
9574.04	2055	1.39681	1.24849	9.97641
9592.55	2060	1.39681	1.25005	9.97644
9611.03	2065	1.39682	1.25162	9.97646
9629.51	2070	1.39682	1.25318	9.97649
9647.97	2075	1.39683	1.25475	9.97652
9666.42	2080	1.39683	1.25631	9.97654
9684.85	2085	1.39684	1.25787	9.97657
9703.28	2090	1.39684	1.25942	9.9766
9721.69	2095	1.39685	1.26098	9.97662
9740.08	2100	1.39685	1.26253	9.97665
9758.47	2105	1.39686	1.26409	9.97667
9776.84	2110	1.39686	1.26564	9.9767
9795.19	2115	1.39687	1.26718	9.97672
9813.54	2120	1.39687	1.26873	9.97675
9831.87	2125	1.39688	1.27028	9.97678
9850.19	2130	1.39688	1.27182	9.9768
9868.5	2135	1.39689	1.27336	9.97683
9886.79	2140	1.39689	1.2749	9.97685
9905.07	2145	1.3969	1.27644	9.97688
9923.34	2150	1.3969	1.27798	9.9769
9941.6	2155	1.39691	1.27951	9.97693
9959.84	2160	1.39691	1.28105	9.97695
9978.07	2165	1.39692	1.28258	9.97698
9996.29	2170	1.39692	1.28411	9.977
10014.5	2175	1.39693	1.28564	9.97703
10032.7	2180	1.39693	1.28717	9.97705

Ilustración 45.- Iteración 2 de Levenberg-Marquardt para Suelo Arcilla.

Tabla 2. Segunda iteración Levenberg-Marquardt para suelo arcilla

Iteración Levenberg-Marquardt 2				
0	0	0	0	0
78.2866	5	0.758949	0.053887	78.2866
139.789	10	0.972198	0.0816845	6.53449
183.903	15	1.08182	0.100174	8.18166
215.734	20	1.14874	0.115323	8.78984
253.286	25	1.19228	0.128526	9.12521
292.126	30	1.22262	0.140402	9.32354
328.646	35	1.24546	0.151295	9.44716
363.671	40	1.26375	0.161421	9.53019
398.706	45	1.27894	0.170925	9.59116
433.492	50	1.29175	0.179914	9.63905
467.665	55	1.30266	0.188463	9.67795
501.348	60	1.31203	0.196634	9.70998
534.731	65	1.32013	0.204473	9.73665
567.817	70	1.3272	0.212019	9.75913
600.586	75	1.33339	0.219303	9.7783
633.072	80	1.33885	0.226351	9.79483

Iteración Levenberg-Marquardt 2				
665.314	85	1.34368	0.233186	9.80919
697.326	90	1.34797	0.239824	9.82176
729.119	95	1.35179	0.246284	9.83281
760.71	100	1.35521	0.252579	9.84259
792.112	105	1.35827	0.258721	9.85128
823.337	110	1.36102	0.264721	9.85904
854.394	115	1.3635	0.270588	9.86599
885.293	120	1.36574	0.276332	9.87225
916.041	125	1.36776	0.28196	9.8779
946.647	130	1.36959	0.287478	9.88302
977.117	135	1.37126	0.292894	9.88767
1007.46	140	1.37277	0.298212	9.8919
1037.67	145	1.37415	0.303438	9.89577
1067.77	150	1.37542	0.308577	9.89932
1097.75	155	1.37657	0.313633	9.90257
1127.62	160	1.37762	0.318609	9.90557
1157.39	165	1.37859	0.32351	9.90833

Iteración Levenberg-Marquardt 2				
1187.06	170	1.37948	0.328339	9.91088
1216.62	175	1.3803	0.333099	9.91325
1246.09	180	1.38105	0.337794	9.91545
1275.47	185	1.38175	0.342425	9.91749
1304.75	190	1.38239	0.346995	9.91939
1333.95	195	1.38298	0.351507	9.92117
1363.06	200	1.38354	0.355963	9.92283
1392.09	205	1.38405	0.360365	9.92439
1421.04	210	1.38452	0.364715	9.92585
1449.92	215	1.38496	0.369015	9.92723
1478.71	220	1.38538	0.373266	9.92853
1507.43	225	1.38576	0.377471	9.92975
1536.08	230	1.38612	0.38163	9.9309
1564.65	235	1.38646	0.385746	9.932
1593.15	240	1.38677	0.389819	9.93303
1621.59	245	1.38707	0.393851	9.93402
1649.95	250	1.38735	0.397843	9.93495

Iteración Levenberg-Marquardt 2

1678.25	255	1.38761	0.401797	9.93584
1706.49	260	1.38786	0.405713	9.93669
1734.66	265	1.38809	0.409593	9.9375
1762.77	270	1.38831	0.413437	9.93828
1790.82	275	1.38852	0.417247	9.93902
1818.8	280	1.38872	0.421023	9.93973
1846.73	285	1.3889	0.424766	9.94041
1874.59	290	1.38908	0.428478	9.94106
1902.4	295	1.38925	0.432159	9.94169
1930.15	300	1.38941	0.43581	9.9423
1957.85	305	1.38957	0.439431	9.94288
1985.49	310	1.38971	0.443024	9.94344
2013.07	315	1.38985	0.446589	9.94398
2040.6	320	1.38999	0.450126	9.94451
2068.08	325	1.39012	0.453637	9.94501
2095.5	330	1.39024	0.457121	9.9455
2122.87	335	1.39036	0.46058	9.94598
2150.19	340	1.39047	0.464014	9.94644
2177.46	345	1.39058	0.467424	9.94689
2204.68	350	1.39069	0.47081	9.94732
2231.85	355	1.39079	0.474172	9.94774
2258.97	360	1.39089	0.477512	9.94815
2286.04	365	1.39099	0.480829	9.94855
2313.06	370	1.39108	0.484125	9.94894
2340.03	375	1.39117	0.487399	9.94932
2366.96	380	1.39125	0.490651	9.94968
2393.84	385	1.39134	0.493883	9.95004
2420.67	390	1.39142	0.497095	9.95039
2447.46	395	1.3915	0.500287	9.95073
2474.2	400	1.39157	0.50346	9.95107
2500.9	405	1.39165	0.506613	9.95139
2527.55	410	1.39172	0.509748	9.95171
2554.16	415	1.39179	0.512864	9.95203
2580.73	420	1.39186	0.515962	9.95233
2607.25	425	1.39192	0.519043	9.95263
2633.73	430	1.39199	0.522106	9.95292
2660.16	435	1.39205	0.525152	9.95321

Iteración Levenberg-Marquardt 2

2686.55	440	1.39212	0.52818	9.95349
2712.9	445	1.39218	0.531193	9.95376
2739.21	450	1.39223	0.534189	9.95403
2765.48	455	1.39229	0.537169	9.9543
2791.71	460	1.39235	0.540133	9.95456
2817.89	465	1.3924	0.543082	9.95481
2844.04	470	1.39246	0.546015	9.95506
2870.14	475	1.39251	0.548934	9.95531
2896.21	480	1.39256	0.551837	9.95555
2922.23	485	1.39262	0.554726	9.95579
2948.22	490	1.39267	0.557601	9.95602
2974.17	495	1.39271	0.560462	9.95625
3000.08	500	1.39276	0.563309	9.95647
3025.95	505	1.39281	0.566142	9.95669
3051.78	510	1.39286	0.568961	9.95691
3077.57	515	1.3929	0.571768	9.95713
3103.33	520	1.39295	0.574561	9.95734
3129.05	525	1.39299	0.577341	9.95754
3154.73	530	1.39303	0.580109	9.95775
3180.38	535	1.39308	0.582864	9.95795
3205.99	540	1.39312	0.585607	9.95815
3231.56	545	1.39316	0.588337	9.95834
3257.1	550	1.3932	0.591056	9.95854
3282.6	555	1.39324	0.593762	9.95873
3308.06	560	1.39328	0.596457	9.95891
3333.49	565	1.39332	0.59914	9.9591
3358.89	570	1.39335	0.601812	9.95928
3384.25	575	1.39339	0.604473	9.95946
3409.57	580	1.39343	0.607123	9.95963
3434.86	585	1.39346	0.609761	9.95981
3460.11	590	1.3935	0.612389	9.95998
3485.33	595	1.39354	0.615006	9.96015
3510.52	600	1.39357	0.617613	9.96031
3535.68	605	1.3936	0.620209	9.96048
3560.79	610	1.39364	0.622795	9.96064
3585.88	615	1.39367	0.62537	9.9608
3610.93	620	1.3937	0.627936	9.96096

Iteración Levenberg-Marquardt 2

3635.95	625	1.39374	0.630492	9.96112
3660.94	630	1.39377	0.633038	9.96127
3685.89	635	1.3938	0.635574	9.96143
3710.82	640	1.39383	0.638101	9.96158
3735.71	645	1.39386	0.640618	9.96172
3760.56	650	1.39389	0.643126	9.96187
3785.39	655	1.39392	0.645624	9.96202
3810.18	660	1.39395	0.648114	9.96216
3834.94	665	1.39398	0.650594	9.9623
3859.68	670	1.39401	0.653066	9.96244
3884.37	675	1.39404	0.655528	9.96258
3909.04	680	1.39407	0.657982	9.96272
3933.68	685	1.39409	0.660428	9.96285
3958.29	690	1.39412	0.662865	9.96299
3982.86	695	1.39415	0.665293	9.96312
4007.41	700	1.39417	0.667713	9.96325
4031.92	705	1.3942	0.670125	9.96338
4056.41	710	1.39423	0.672528	9.96351
4080.86	715	1.39425	0.674923	9.96363
4105.29	720	1.39428	0.677311	9.96376
4129.68	725	1.3943	0.67969	9.96388
4154.05	730	1.39433	0.682062	9.96401
4178.38	735	1.39435	0.684426	9.96413
4202.69	740	1.39438	0.686782	9.96425
4226.97	745	1.3944	0.689131	9.96437
4251.22	750	1.39443	0.691472	9.96448
4275.44	755	1.39445	0.693805	9.9646
4299.63	760	1.39447	0.696131	9.96471
4323.79	765	1.3945	0.69845	9.96483
4347.92	770	1.39452	0.700762	9.96494
4372.03	775	1.39454	0.703066	9.96505
4396.11	780	1.39456	0.705364	9.96516
4420.16	785	1.39459	0.707654	9.96527
4444.18	790	1.39461	0.709937	9.96538
4468.17	795	1.39463	0.712214	9.96549
4492.14	800	1.39465	0.714483	9.96559
4516.08	805	1.39467	0.716746	9.9657

Iteración Levenberg-Marquardt 2				
4539.99	810	1.39469	0.719002	9.9658
4563.87	815	1.39472	0.721252	9.96591
4587.73	820	1.39474	0.723495	9.96601
4611.56	825	1.39476	0.725731	9.96611
4635.36	830	1.39478	0.727961	9.96621
4659.14	835	1.3948	0.730185	9.96631
4682.88	840	1.39482	0.732402	9.96641
4706.61	845	1.39484	0.734613	9.96651
4730.3	850	1.39486	0.736817	9.9666
4753.97	855	1.39488	0.739016	9.9667
4777.61	860	1.39489	0.741208	9.96679
4801.23	865	1.39491	0.743394	9.96689
4824.82	870	1.39493	0.745574	9.96698
4848.39	875	1.39495	0.747749	9.96707
4871.93	880	1.39497	0.749917	9.96717
4895.44	885	1.39499	0.752079	9.96726
4918.93	890	1.39501	0.754236	9.96735
4942.39	895	1.39502	0.756387	9.96744
4965.83	900	1.39504	0.758532	9.96752
4989.24	905	1.39506	0.760672	9.96761
5012.63	910	1.39508	0.762805	9.9677
5035.99	915	1.39509	0.764934	9.96779
5059.32	920	1.39511	0.767056	9.96787
5082.64	925	1.39513	0.769173	9.96796
5105.92	930	1.39515	0.771285	9.96804
5129.18	935	1.39516	0.773392	9.96812
5152.42	940	1.39518	0.775493	9.96821
5175.64	945	1.3952	0.777588	9.96829
5198.82	950	1.39521	0.779679	9.96837
5221.99	955	1.39523	0.781764	9.96845
5245.13	960	1.39524	0.783844	9.96853
5268.24	965	1.39526	0.785919	9.96861
5291.34	970	1.39528	0.787988	9.96869
5314.41	975	1.39529	0.790053	9.96877
5337.45	980	1.39531	0.792112	9.96884
5360.47	985	1.39532	0.794167	9.96892
5383.47	990	1.39534	0.796217	9.969

Iteración Levenberg-Marquardt 2				
5406.44	995	1.39535	0.798261	9.96907
5429.39	1000	1.39537	0.800301	9.96915
5452.32	1005	1.39538	0.802336	9.96922
5475.22	1010	1.3954	0.804366	9.9693
5498.1	1015	1.39541	0.806392	9.96937
5520.96	1020	1.39543	0.808412	9.96944
5543.79	1025	1.39544	0.810428	9.96952
5566.6	1030	1.39546	0.81244	9.96959
5589.39	1035	1.39547	0.814446	9.96966
5612.16	1040	1.39548	0.816448	9.96973
5634.9	1045	1.3955	0.818446	9.9698
5657.62	1050	1.39551	0.820439	9.96987
5680.32	1055	1.39553	0.822427	9.96994
5702.99	1060	1.39554	0.824411	9.97001
5725.65	1065	1.39555	0.82639	9.97008
5748.28	1070	1.39557	0.828365	9.97014
5770.88	1075	1.39558	0.830336	9.97021
5793.47	1080	1.39559	0.832303	9.97028
5816.03	1085	1.39561	0.834265	9.97035
5838.58	1090	1.39562	0.836222	9.97041
5861.1	1095	1.39563	0.838176	9.97048
5883.6	1100	1.39565	0.840125	9.97054
5906.07	1105	1.39566	0.84207	9.97061
5928.53	1110	1.39567	0.844011	9.97067
5950.96	1115	1.39569	0.845948	9.97073
5973.37	1120	1.3957	0.84788	9.9708
5995.76	1125	1.39571	0.849809	9.97086
6018.13	1130	1.39572	0.851733	9.97092
6040.48	1135	1.39574	0.853654	9.97098
6062.81	1140	1.39575	0.85557	9.97105
6085.11	1145	1.39576	0.857482	9.97111
6107.4	1150	1.39577	0.859391	9.97117
6129.66	1155	1.39578	0.861295	9.97123
6151.9	1160	1.3958	0.863196	9.97129
6174.12	1165	1.39581	0.865093	9.97135
6196.33	1170	1.39582	0.866986	9.97141
6218.51	1175	1.39583	0.868875	9.97146
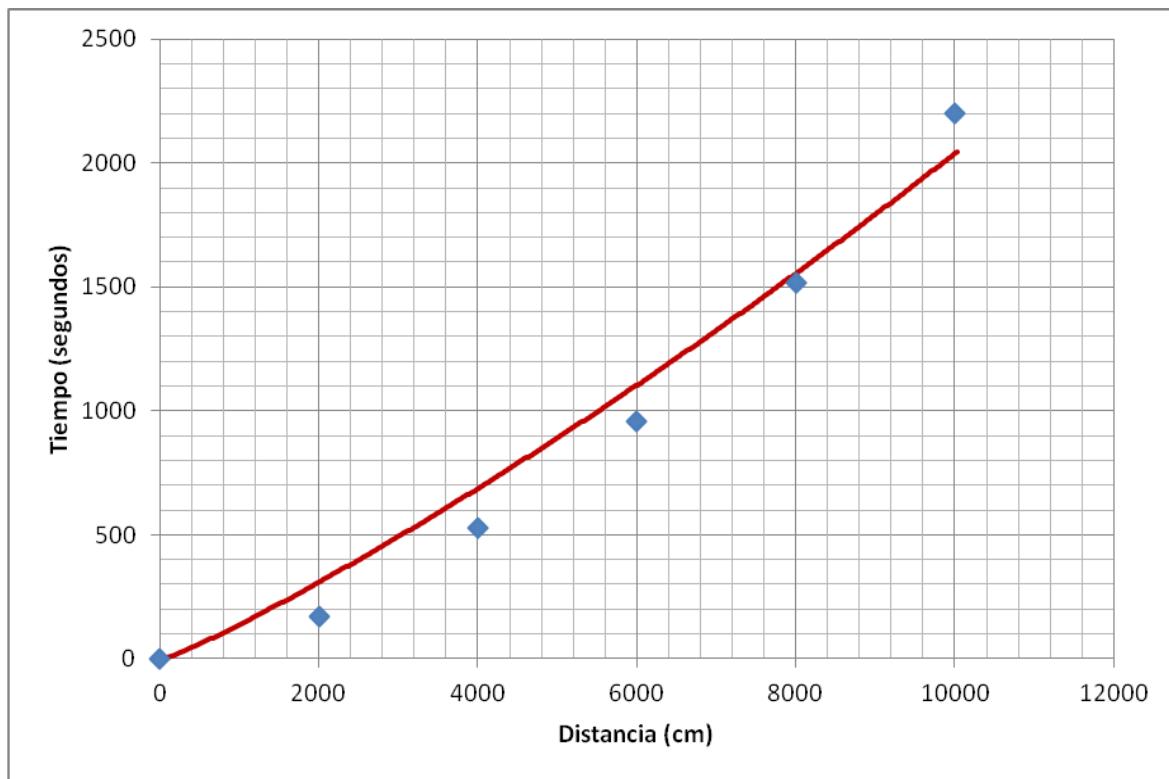
Iteración Levenberg-Marquardt 2				
6240.67	1180	1.39584	0.87076	9.97152
6262.8	1185	1.39585	0.872641	9.97158
6284.92	1190	1.39587	0.874519	9.97164
6307.02	1195	1.39588	0.876393	9.9717
6329.1	1200	1.39589	0.878263	9.97175
6351.16	1205	1.3959	0.88013	9.97181
6373.19	1210	1.39591	0.881993	9.97187
6395.21	1215	1.39592	0.883852	9.97192
6417.21	1220	1.39593	0.885708	9.97198
6439.18	1225	1.39594	0.88756	9.97203
6461.14	1230	1.39595	0.889408	9.97209
6483.08	1235	1.39597	0.891253	9.97214
6504.99	1240	1.39598	0.893094	9.9722
6526.89	1245	1.39599	0.894932	9.97225
6548.77	1250	1.396	0.896766	9.9723
6570.62	1255	1.39601	0.898597	9.97236
6592.46	1260	1.39602	0.900425	9.97241
6614.28	1265	1.39603	0.902249	9.97246
6636.08	1270	1.39604	0.904069	9.97251
6657.86	1275	1.39605	0.905887	9.97256
6679.62	1280	1.39606	0.9077	9.97262
6701.36	1285	1.39607	0.909511	9.97267
6723.08	1290	1.39608	0.911318	9.97272
6744.78	1295	1.39609	0.913122	9.97277
6766.47	1300	1.3961	0.914922	9.97282
6788.13	1305	1.39611	0.91672	9.97287
6809.78	1310	1.39612	0.918514	9.97292
6831.4	1315	1.39613	0.920304	9.97297
6853.01	1320	1.39614	0.922092	9.97302
6874.6	1325	1.39615	0.923876	9.97307
6896.17	1330	1.39616	0.925658	9.97311
6917.72	1335	1.39617	0.927436	9.97316
6939.25	1340	1.39618	0.929211	9.97321
6960.77	1345	1.39619	0.930982	9.97326
6982.26	1350	1.3962	0.932751	9.97331
7003.74	1355	1.39621	0.934516	9.97335
7025.2	1360	1.39622	0.936279	9.9734

Iteración Levenberg-Marquardt 2

7046.64	1365	1.39623	0.938038	9.97345
7068.06	1370	1.39623	0.939795	9.97349
7089.46	1375	1.39624	0.941548	9.97354
7110.85	1380	1.39625	0.943298	9.97359
7132.21	1385	1.39626	0.945046	9.97363
7153.56	1390	1.39627	0.94679	9.97368
7174.89	1395	1.39628	0.948532	9.97372
7196.2	1400	1.39629	0.95027	9.97377
7217.5	1405	1.3963	0.952006	9.97381
7238.77	1410	1.39631	0.953738	9.97386
7260.03	1415	1.39631	0.955468	9.9739
7281.27	1420	1.39632	0.957195	9.97394
7302.5	1425	1.39633	0.958919	9.97399
7323.7	1430	1.39634	0.96064	9.97403
7344.89	1435	1.39635	0.962358	9.97407
7366.06	1440	1.39636	0.964074	9.97412
7387.21	1445	1.39637	0.965786	9.97416
7408.35	1450	1.39637	0.967496	9.9742
7429.47	1455	1.39638	0.969203	9.97425
7450.57	1460	1.39639	0.970908	9.97429
7471.65	1465	1.3964	0.972609	9.97433
7492.71	1470	1.39641	0.974308	9.97437
7513.76	1475	1.39642	0.976004	9.97441
7534.79	1480	1.39642	0.977698	9.97445
7555.81	1485	1.39643	0.979388	9.97449
7576.8	1490	1.39644	0.981076	9.97454
7597.78	1495	1.39645	0.982762	9.97458
7618.75	1500	1.39646	0.984444	9.97462
7639.69	1505	1.39646	0.986125	9.97466
7660.62	1510	1.39647	0.987802	9.9747
7681.53	1515	1.39648	0.989477	9.97474
7702.43	1520	1.39649	0.991149	9.97478
7723.3	1525	1.3965	0.992819	9.97482
7744.16	1530	1.3965	0.994486	9.97486
7765.01	1535	1.39651	0.99615	9.97489
7785.84	1540	1.39652	0.997812	9.97493
7806.65	1545	1.39653	0.999472	9.97497

Iteración Levenberg-Marquardt 2

7827.44	1550	1.39653	1.00113	9.97501
7848.22	1555	1.39654	1.00278	9.97505
7868.98	1560	1.39655	1.00443	9.97509
7889.73	1565	1.39656	1.00608	9.97512
7910.46	1570	1.39656	1.00773	9.97516
7931.17	1575	1.39657	1.00938	9.9752
7951.86	1580	1.39658	1.01102	9.97524
7972.54	1585	1.39659	1.01266	9.97527
7993.21	1590	1.39659	1.01429	9.97531
8013.86	1595	1.3966	1.01593	9.97535
8034.49	1600	1.39661	1.01756	9.97538
8055.1	1605	1.39662	1.01919	9.97542
8075.7	1610	1.39662	1.02082	9.97546
8096.28	1615	1.39663	1.02244	9.97549
8116.85	1620	1.39664	1.02407	9.97553
8137.4	1625	1.39664	1.02569	9.97557
8157.94	1630	1.39665	1.0273	9.9756
8178.46	1635	1.39666	1.02892	9.97564
8198.96	1640	1.39667	1.03053	9.97567
8219.45	1645	1.39667	1.03214	9.97571
8239.92	1650	1.39668	1.03375	9.97574
8260.38	1655	1.39669	1.03536	9.97578
8280.82	1660	1.39669	1.03696	9.97581
8301.24	1665	1.3967	1.03857	9.97585
8321.65	1670	1.39671	1.04017	9.97588
8342.04	1675	1.39671	1.04176	9.97591
8362.42	1680	1.39672	1.04336	9.97595
8382.78	1685	1.39673	1.04495	9.97598
8403.13	1690	1.39673	1.04654	9.97602
8423.46	1695	1.39674	1.04813	9.97605
8443.78	1700	1.39675	1.04972	9.97608
8464.08	1705	1.39675	1.0513	9.97612
8484.37	1710	1.39676	1.05288	9.97615
8504.64	1715	1.39677	1.05446	9.97618
8524.89	1720	1.39677	1.05604	9.97622
8545.13	1725	1.39678	1.05762	9.97625
8565.36	1730	1.39679	1.05919	9.97628

Iteración Levenberg-Marquardt 2

8585.57	1735	1.39679	1.06076	9.97631
8605.77	1740	1.3968	1.06233	9.97635
8625.95	1745	1.3968	1.0639	9.97638
8646.11	1750	1.39681	1.06546	9.97641
8666.26	1755	1.39682	1.06702	9.97644
8686.4	1760	1.39682	1.06859	9.97647
8706.52	1765	1.39683	1.07014	9.9765
8726.62	1770	1.39684	1.0717	9.97654
8746.71	1775	1.39684	1.07325	9.97657
8766.79	1780	1.39685	1.07481	9.9766
8786.85	1785	1.39685	1.07636	9.97663
8806.9	1790	1.39686	1.07791	9.97666
8826.93	1795	1.39687	1.07945	9.97669
8846.95	1800	1.39687	1.081	9.97672
8866.95	1805	1.39688	1.08254	9.97675
8886.94	1810	1.39688	1.08408	9.97678
8906.91	1815	1.39689	1.08562	9.97681
8926.87	1820	1.3969	1.08715	9.97684
8946.81	1825	1.3969	1.08869	9.97687
8966.74	1830	1.39691	1.09022	9.9769
8986.66	1835	1.39691	1.09175	9.97693
9006.56	1840	1.39692	1.09328	9.97696
9026.45	1845	1.39693	1.09481	9.97699
9046.32	1850	1.39693	1.09633	9.97702
9066.18	1855	1.39694	1.09785	9.97705
9086.03	1860	1.39694	1.09937	9.97708
9105.86	1865	1.39695	1.10089	9.97711
9125.67	1870	1.39695	1.10241	9.97714
9145.47	1875	1.39696	1.10392	9.97717
9165.26	1880	1.39697	1.10544	9.97719
9185.04	1885	1.39697	1.10695	9.97722
9204.8	1890	1.39698	1.10846	9.97725
9224.54	1895	1.39698	1.10997	9.97728
9244.27	1900	1.39699	1.11147	9.97731
9263.99	1905	1.39699	1.11298	9.97734
9283.69	1910	1.397	1.11448	9.97736
9303.38	1915	1.397	1.11598	9.97739
9323.06	1920	1.39701	1.11748	9.97742
9342.72	1925	1.39702	1.11897	9.97745
9362.37	1930	1.39702	1.12047	9.97748
9382.01	1935	1.39703	1.12196	9.9775
9401.63	1940	1.39703	1.12345	9.97753
9421.24	1945	1.39704	1.12494	9.97756
9440.83	1950	1.39704	1.12643	9.97758
9460.41	1955	1.39705	1.12791	9.97761
9479.98	1960	1.39705	1.1294	9.97764
9499.53	1965	1.39706	1.13088	9.97767
9519.07	1970	1.39706	1.13236	9.97769
9538.6	1975	1.39707	1.13384	9.97772
9558.11	1980	1.39707	1.13531	9.97775
9577.61	1985	1.39708	1.13679	9.97777
9597.09	1990	1.39708	1.13826	9.9778
9616.57	1995	1.39709	1.13973	9.97782
9636.03	2000	1.39709	1.1412	9.97785
9655.47	2005	1.3971	1.14267	9.97788
9674.9	2010	1.3971	1.14414	9.9779
9694.32	2015	1.39711	1.1456	9.97793
9713.73	2020	1.39712	1.14707	9.97795
9733.12	2025	1.39712	1.14853	9.97798
9752.5	2030	1.39713	1.14999	9.978
9771.87	2035	1.39713	1.15145	9.97803
9791.22	2040	1.39714	1.1529	9.97806
9810.56	2045	1.39714	1.15436	9.97808
9829.89	2050	1.39715	1.15581	9.97811

"Diseño y aplicación de riego por gravedad"
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Iteración Levenberg-Marquardt 2				
9849.2	2055	1.39715	1.15726	9.97813
9868.5	2060	1.39715	1.15871	9.97816
9887.79	2065	1.39716	1.16016	9.97818
9907.07	2070	1.39716	1.16161	9.97821
9926.33	2075	1.39717	1.16305	9.97823
9945.58	2080	1.39717	1.16449	9.97825
9964.81	2085	1.39718	1.16594	9.97828
9984.04	2090	1.39718	1.16738	9.9783
10003.2	2095	1.39719	1.16881	9.97833
10022.4	2100	1.39719	1.17025	9.97835

Ilustración 46.- Iteración 3 de Levenberg-Marquardt para Suelo Arcilla.

Tabla 3. Tercera iteración Levenberg-Marquardt para suelo arcilla

Iteración Levenberg-Marquardt 3					Iteración Levenberg-Marquardt 3					Iteración Levenberg-Marquardt 3				
0	0	0	0	0	669.436	85	1.34485	0.219717	9.81455	1196.35	170	1.3804	0.309325	9.91498
78.6156	5	0.759644	0.0507861	78.6156	701.723	90	1.34913	0.22597	9.82702	1226.25	175	1.3812	0.313807	9.91729
140.382	10	0.972942	0.076985	6.54034	733.795	95	1.35294	0.232054	9.83798	1256.06	180	1.38194	0.318227	9.91944
184.749	15	1.08267	0.0944087	8.1871	765.669	100	1.35634	0.237982	9.84767	1285.77	185	1.38263	0.322587	9.92143
216.749	20	1.1497	0.108684	8.79555	797.358	105	1.35938	0.243767	9.85627	1315.4	190	1.38326	0.32689	9.92328
254.465	25	1.19334	0.121124	9.13115	828.874	110	1.36212	0.249418	9.86395	1344.95	195	1.38384	0.331138	9.92501
293.521	30	1.22376	0.132313	9.32969	860.225	115	1.36458	0.254943	9.87082	1374.41	200	1.38438	0.335333	9.92663
330.278	35	1.24664	0.142576	9.45342	891.422	120	1.3668	0.260353	9.877	1403.79	205	1.38488	0.339478	9.92814
365.528	40	1.26496	0.152116	9.53646	922.472	125	1.36881	0.265652	9.88258	1433.09	210	1.38534	0.343573	9.92956
400.787	45	1.28016	0.16107	9.59735	953.384	130	1.37063	0.270849	9.88762	1462.32	215	1.38577	0.347621	9.93089
435.811	50	1.29298	0.169537	9.64514	984.162	135	1.37228	0.275949	9.8922	1491.47	220	1.38618	0.351623	9.93215
470.23	55	1.30389	0.177591	9.68392	1014.81	140	1.37378	0.280957	9.89637	1520.55	225	1.38655	0.355582	9.93333
504.161	60	1.31325	0.185288	9.71584	1045.35	145	1.37514	0.285878	9.90017	1549.56	230	1.3869	0.359497	9.93444
537.796	65	1.32135	0.192673	9.7424	1075.76	150	1.37639	0.290717	9.90365	1578.5	235	1.38723	0.363371	9.9355
571.139	70	1.32841	0.199781	9.76478	1106.06	155	1.37753	0.295477	9.90685	1607.38	240	1.38753	0.367206	9.9365
604.171	75	1.33459	0.206642	9.78385	1136.26	160	1.37857	0.300163	9.90978	1636.18	245	1.38782	0.371001	9.93745
636.924	80	1.34004	0.21328	9.80028	1166.36	165	1.37952	0.304778	9.91249	1664.92	250	1.38809	0.374759	9.93835

Iteración Levenberg-Marquardt 3				
1693.6	255	1.38834	0.378481	9.9392
1722.21	260	1.38858	0.382167	9.94002
1750.77	265	1.38881	0.385819	9.9408
1779.26	270	1.38902	0.389438	9.94154
1807.69	275	1.38922	0.393024	9.94225
1836.06	280	1.38941	0.396578	9.94293
1864.38	285	1.38959	0.400102	9.94358
1892.64	290	1.38976	0.403596	9.94421
1920.84	295	1.38993	0.407061	9.94481
1948.99	300	1.39008	0.410497	9.94539
1977.08	305	1.39023	0.413905	9.94594
2005.12	310	1.39037	0.417287	9.94648
2033.11	315	1.3905	0.420642	9.947
2061.04	320	1.39063	0.423971	9.9475
2088.92	325	1.39075	0.427275	9.94798
2116.76	330	1.39087	0.430555	9.94845
2144.54	335	1.39099	0.43381	9.9489
2172.27	340	1.39109	0.437042	9.94934
2199.95	345	1.3912	0.440251	9.94976
2227.59	350	1.3913	0.443438	9.95017
2255.17	355	1.3914	0.446602	9.95058
2282.71	360	1.39149	0.449745	9.95096
2310.2	365	1.39158	0.452867	9.95134
2337.65	370	1.39167	0.455968	9.95171
2365.05	375	1.39175	0.459049	9.95207
2392.4	380	1.39184	0.46211	9.95242
2419.71	385	1.39191	0.465152	9.95276
2446.97	390	1.39199	0.468174	9.95309
2474.19	395	1.39207	0.471178	9.95342
2501.37	400	1.39214	0.474163	9.95374
2528.5	405	1.39221	0.477131	9.95405
2555.59	410	1.39228	0.48008	9.95435
2582.64	415	1.39234	0.483013	9.95464
2609.65	420	1.39241	0.485928	9.95493
2636.61	425	1.39247	0.488827	9.95522
2663.53	430	1.39253	0.491709	9.95549
2690.41	435	1.39259	0.494575	9.95576

Iteración Levenberg-Marquardt 3				
2717.25	440	1.39265	0.497425	9.95603
2744.05	445	1.39271	0.500259	9.95629
2770.81	450	1.39277	0.503078	9.95655
2797.53	455	1.39282	0.505882	9.9568
2824.2	460	1.39287	0.508671	9.95704
2850.84	465	1.39293	0.511446	9.95729
2877.45	470	1.39298	0.514206	9.95752
2904.01	475	1.39303	0.516952	9.95776
2930.53	480	1.39308	0.519684	9.95798
2957.02	485	1.39313	0.522402	9.95821
2983.47	490	1.39317	0.525107	9.95843
3009.88	495	1.39322	0.527798	9.95865
3036.25	500	1.39326	0.530476	9.95886
3062.59	505	1.39331	0.533142	9.95907
3088.89	510	1.39335	0.535795	9.95928
3115.15	515	1.3934	0.538435	9.95948
3141.37	520	1.39344	0.541063	9.95968
3167.57	525	1.39348	0.543678	9.95987
3193.72	530	1.39352	0.546282	9.96007
3219.84	535	1.39356	0.548874	9.96026
3245.92	540	1.3936	0.551454	9.96045
3271.97	545	1.39364	0.554023	9.96063
3297.99	550	1.39368	0.55658	9.96081
3323.96	555	1.39371	0.559126	9.96099
3349.91	560	1.39375	0.561662	9.96117
3375.82	565	1.39379	0.564186	9.96134
3401.7	570	1.39382	0.566699	9.96152
3427.54	575	1.39386	0.569202	9.96169
3453.35	580	1.39389	0.571695	9.96185
3479.12	585	1.39393	0.574177	9.96202
3504.87	590	1.39396	0.576649	9.96218
3530.57	595	1.39399	0.579111	9.96234
3556.25	600	1.39403	0.581563	9.9625
3581.9	605	1.39406	0.584005	9.96265
3607.51	610	1.39409	0.586437	9.96281
3633.09	615	1.39412	0.58886	9.96296
3658.63	620	1.39415	0.591273	9.96311

Iteración Levenberg-Marquardt 3				
3684.15	625	1.39418	0.593677	9.96326
3709.63	630	1.39421	0.596072	9.96341
3735.08	635	1.39424	0.598458	9.96355
3760.5	640	1.39427	0.600834	9.96369
3785.89	645	1.3943	0.603202	9.96383
3811.25	650	1.39433	0.605561	9.96397
3836.58	655	1.39436	0.607911	9.96411
3861.87	660	1.39439	0.610253	9.96425
3887.14	665	1.39441	0.612586	9.96438
3912.37	670	1.39444	0.61491	9.96451
3937.58	675	1.39447	0.617227	9.96464
3962.75	680	1.3945	0.619535	9.96477
3987.9	685	1.39452	0.621835	9.9649
4013.01	690	1.39455	0.624126	9.96503
4038.1	695	1.39457	0.62641	9.96515
4063.15	700	1.3946	0.628686	9.96528
4088.18	705	1.39462	0.630955	9.9654
4113.18	710	1.39465	0.633215	9.96552
4138.15	715	1.39467	0.635468	9.96564
4163.09	720	1.3947	0.637713	9.96576
4188	725	1.39472	0.639951	9.96588
4212.88	730	1.39474	0.642182	9.96599
4237.73	735	1.39477	0.644405	9.96611
4262.56	740	1.39479	0.646621	9.96622
4287.36	745	1.39481	0.648829	9.96634
4312.12	750	1.39484	0.651031	9.96645
4336.87	755	1.39486	0.653226	9.96656
4361.58	760	1.39488	0.655413	9.96667
4386.26	765	1.3949	0.657594	9.96677
4410.92	770	1.39492	0.659768	9.96688
4435.55	775	1.39494	0.661935	9.96699
4460.15	780	1.39497	0.664095	9.96709
4484.73	785	1.39499	0.666249	9.96719
4509.28	790	1.39501	0.668397	9.9673
4533.8	795	1.39503	0.670537	9.9674
4558.3	800	1.39505	0.672672	9.9675
4582.76	805	1.39507	0.674799	9.9676

Iteración Levenberg-Marquardt 3				
4607.2	810	1.39509	0.676921	9.9677
4631.62	815	1.39511	0.679036	9.96779
4656.01	820	1.39513	0.681146	9.96789
4680.37	825	1.39515	0.683249	9.96799
4704.71	830	1.39517	0.685345	9.96808
4729.02	835	1.39519	0.687436	9.96818
4753.3	840	1.3952	0.689521	9.96827
4777.56	845	1.39522	0.6916	9.96836
4801.79	850	1.39524	0.693673	9.96845
4826	855	1.39526	0.69574	9.96854
4850.18	860	1.39528	0.697802	9.96863
4874.34	865	1.3953	0.699857	9.96872
4898.47	870	1.39531	0.701907	9.96881
4922.58	875	1.39533	0.703952	9.9689
4946.66	880	1.39535	0.705991	9.96899
4970.71	885	1.39537	0.708024	9.96907
4994.74	890	1.39538	0.710052	9.96916
5018.75	895	1.3954	0.712074	9.96924
5042.73	900	1.39542	0.714091	9.96933
5066.69	905	1.39543	0.716103	9.96941
5090.62	910	1.39545	0.718109	9.96949
5114.53	915	1.39547	0.72011	9.96957
5138.41	920	1.39548	0.722106	9.96965
5162.27	925	1.3955	0.724096	9.96973
5186.11	930	1.39551	0.726082	9.96981
5209.92	935	1.39553	0.728062	9.96989
5233.71	940	1.39555	0.730038	9.96997
5257.47	945	1.39556	0.732008	9.97005
5281.21	950	1.39558	0.733973	9.97013
5304.93	955	1.39559	0.735934	9.9702
5328.62	960	1.39561	0.737889	9.97028
5352.29	965	1.39562	0.73984	9.97035
5375.94	970	1.39564	0.741786	9.97043
5399.56	975	1.39565	0.743727	9.9705
5423.16	980	1.39567	0.745663	9.97058
5446.74	985	1.39568	0.747595	9.97065
5470.29	990	1.3957	0.749522	9.97072

Iteración Levenberg-Marquardt 3				
5493.83	995	1.39571	0.751444	9.97079
5517.33	1000	1.39572	0.753362	9.97086
5540.82	1005	1.39574	0.755275	9.97094
5564.28	1010	1.39575	0.757183	9.97101
5587.72	1015	1.39577	0.759087	9.97108
5611.14	1020	1.39578	0.760987	9.97114
5634.54	1025	1.39579	0.762882	9.97121
5657.91	1030	1.39581	0.764773	9.97128
5681.26	1035	1.39582	0.766659	9.97135
5704.59	1040	1.39583	0.768541	9.97142
5727.9	1045	1.39585	0.770419	9.97148
5751.18	1050	1.39586	0.772293	9.97155
5774.44	1055	1.39587	0.774162	9.97161
5797.68	1060	1.39589	0.776027	9.97168
5820.9	1065	1.3959	0.777888	9.97174
5844.1	1070	1.39591	0.779744	9.97181
5867.28	1075	1.39593	0.781597	9.97187
5890.43	1080	1.39594	0.783445	9.97193
5913.56	1085	1.39595	0.78529	9.972
5936.67	1090	1.39596	0.78713	9.97206
5959.76	1095	1.39598	0.788966	9.97212
5982.83	1100	1.39599	0.790798	9.97218
6005.88	1105	1.396	0.792627	9.97224
6028.91	1110	1.39601	0.794451	9.97231
6051.91	1115	1.39602	0.796272	9.97237
6074.9	1120	1.39604	0.798088	9.97243
6097.86	1125	1.39605	0.799901	9.97248
6120.8	1130	1.39606	0.80171	9.97254
6143.73	1135	1.39607	0.803515	9.9726
6166.63	1140	1.39608	0.805316	9.97266
6189.51	1145	1.39609	0.807114	9.97272
6212.37	1150	1.39611	0.808908	9.97278
6235.21	1155	1.39612	0.810698	9.97283
6258.03	1160	1.39613	0.812485	9.97289
6280.83	1165	1.39614	0.814267	9.97295
6303.61	1170	1.39615	0.816046	9.973
6326.36	1175	1.39616	0.817822	9.97306
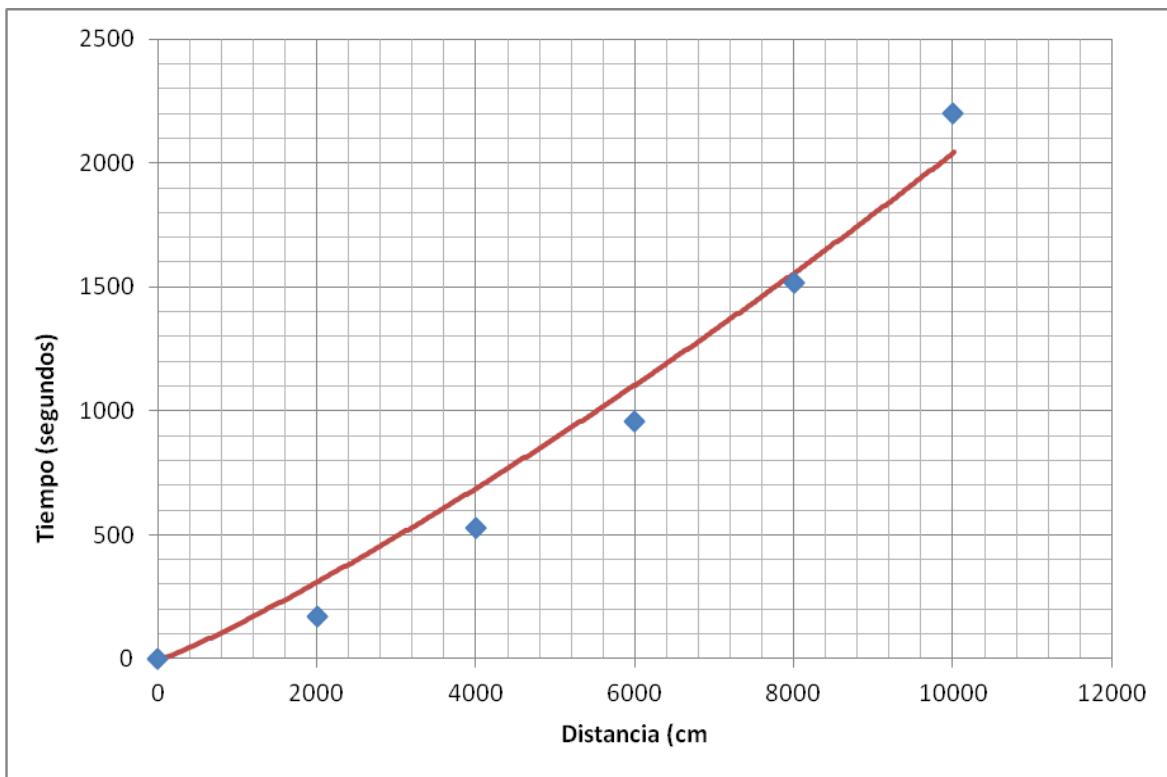
Iteración Levenberg-Marquardt 3				
6349.1	1180	1.39617	0.819594	9.97311
6371.82	1185	1.39618	0.821362	9.97317
6394.52	1190	1.39619	0.823127	9.97322
6417.2	1195	1.3962	0.824889	9.97328
6439.86	1200	1.39622	0.826646	9.97333
6462.49	1205	1.39623	0.828401	9.97338
6485.11	1210	1.39624	0.830152	9.97344
6507.71	1215	1.39625	0.831899	9.97349
6530.29	1220	1.39626	0.833643	9.97354
6552.85	1225	1.39627	0.835384	9.97359
6575.39	1230	1.39628	0.837121	9.97365
6597.91	1235	1.39629	0.838855	9.9737
6620.42	1240	1.3963	0.840586	9.97375
6642.9	1245	1.39631	0.842313	9.9738
6665.36	1250	1.39632	0.844037	9.97385
6687.8	1255	1.39633	0.845758	9.9739
6710.23	1260	1.39634	0.847475	9.97395
6732.63	1265	1.39635	0.849189	9.974
6755.02	1270	1.39636	0.8509	9.97405
6777.39	1275	1.39637	0.852608	9.9741
6799.74	1280	1.39638	0.854313	9.97415
6822.07	1285	1.39639	0.856014	9.9742
6844.38	1290	1.3964	0.857713	9.97424
6866.67	1295	1.39641	0.859408	9.97429
6888.94	1300	1.39642	0.8611	9.97434
6911.2	1305	1.39642	0.862789	9.97439
6933.44	1310	1.39643	0.864475	9.97443
6955.65	1315	1.39644	0.866158	9.97448
6977.85	1320	1.39645	0.867838	9.97453
7000.03	1325	1.39646	0.869515	9.97457
7022.2	1330	1.39647	0.871189	9.97462
7044.34	1335	1.39648	0.87286	9.97467
7066.47	1340	1.39649	0.874528	9.97471
7088.57	1345	1.3965	0.876193	9.97476
7110.66	1350	1.39651	0.877855	9.9748
7132.74	1355	1.39652	0.879514	9.97485
7154.79	1360	1.39652	0.88117	9.97489

"Diseño y aplicación de riego por gravedad"

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Iteración Levenberg-Marquardt 3				
7176.83	1365	1.39653	0.882824	9.97494
7198.84	1370	1.39654	0.884474	9.97498
7220.84	1375	1.39655	0.886122	9.97502
7242.82	1380	1.39656	0.887767	9.97507
7264.79	1385	1.39657	0.889409	9.97511
7286.74	1390	1.39658	0.891048	9.97515
7308.66	1395	1.39658	0.892684	9.9752
7330.58	1400	1.39659	0.894318	9.97524
7352.47	1405	1.3966	0.895949	9.97528
7374.34	1410	1.39661	0.897577	9.97532
7396.2	1415	1.39662	0.899202	9.97536
7418.04	1420	1.39663	0.900825	9.97541
7439.87	1425	1.39663	0.902445	9.97545
7461.67	1430	1.39664	0.904062	9.97549
7483.46	1435	1.39665	0.905677	9.97553
7505.24	1440	1.39666	0.907289	9.97557
7526.99	1445	1.39667	0.908898	9.97561
7548.73	1450	1.39667	0.910505	9.97565
7570.45	1455	1.39668	0.912109	9.97569
7592.15	1460	1.39669	0.91371	9.97573
7613.84	1465	1.3967	0.915309	9.97577
7635.51	1470	1.39671	0.916905	9.97581
7657.16	1475	1.39671	0.918499	9.97585
7678.79	1480	1.39672	0.92009	9.97589
7700.41	1485	1.39673	0.921679	9.97593
7722.02	1490	1.39674	0.923265	9.97597
7743.6	1495	1.39674	0.924848	9.976
7765.17	1500	1.39675	0.926429	9.97604
7786.72	1505	1.39676	0.928008	9.97608
7808.26	1510	1.39677	0.929584	9.97612
7829.78	1515	1.39677	0.931158	9.97616
7851.28	1520	1.39678	0.932729	9.97619
7872.76	1525	1.39679	0.934297	9.97623
7894.23	1530	1.3968	0.935864	9.97627
7915.69	1535	1.3968	0.937428	9.97631
7937.12	1540	1.39681	0.938989	9.97634
7958.54	1545	1.39682	0.940548	9.97638

Iteración Levenberg-Marquardt 3				
7979.95	1550	1.39683	0.942105	9.97642
8001.33	1555	1.39683	0.943659	9.97645
8022.71	1560	1.39684	0.945211	9.97649
8044.06	1565	1.39685	0.946761	9.97652
8065.4	1570	1.39685	0.948308	9.97656
8086.72	1575	1.39686	0.949853	9.9766
8108.03	1580	1.39687	0.951396	9.97663
8129.32	1585	1.39687	0.952936	9.97667
8150.6	1590	1.39688	0.954474	9.9767
8171.86	1595	1.39689	0.95601	9.97674
8193.1	1600	1.3969	0.957543	9.97677
8214.33	1605	1.3969	0.959075	9.9768
8235.54	1610	1.39691	0.960604	9.97684
8256.74	1615	1.39692	0.962131	9.97687
8277.92	1620	1.39692	0.963655	9.97691
8299.09	1625	1.39693	0.965177	9.97694
8320.24	1630	1.39694	0.966697	9.97698
8341.37	1635	1.39694	0.968215	9.97701
8362.49	1640	1.39695	0.969731	9.97704
8383.59	1645	1.39696	0.971245	9.97708
8404.68	1650	1.39696	0.972756	9.97711
8425.75	1655	1.39697	0.974265	9.97714
8446.81	1660	1.39697	0.975772	9.97717
8467.85	1665	1.39698	0.977277	9.97721
8488.88	1670	1.39699	0.97878	9.97724
8509.89	1675	1.39699	0.980281	9.97727
8530.88	1680	1.397	0.981779	9.9773
8551.86	1685	1.39701	0.983276	9.97734
8572.83	1690	1.39701	0.98477	9.97737
8593.78	1695	1.39702	0.986262	9.9774
8614.71	1700	1.39703	0.987753	9.97743
8635.63	1705	1.39703	0.989241	9.97746
8656.54	1710	1.39704	0.990727	9.97749
8677.43	1715	1.39704	0.992211	9.97753
8698.31	1720	1.39705	0.993693	9.97756
8719.17	1725	1.39706	0.995173	9.97759
8740.01	1730	1.39706	0.996651	9.97762

Iteración Levenberg-Marquardt 3				
8760.84	1735	1.39707	0.998127	9.97765
8781.66	1740	1.39707	0.999601	9.97768
8802.46	1745	1.39708	1.00107	9.97771
8823.25	1750	1.39709	1.00254	9.97774
8844.02	1755	1.39709	1.00401	9.97777
8864.78	1760	1.3971	1.00548	9.9778
8885.52	1765	1.3971	1.00694	9.97783
8906.25	1770	1.39711	1.0084	9.97786
8926.96	1775	1.39712	1.00986	9.97789
8947.66	1780	1.39712	1.01132	9.97792
8968.34	1785	1.39713	1.01278	9.97795
8989.01	1790	1.39713	1.01423	9.97798
9009.67	1795	1.39714	1.01568	9.97801
9030.31	1800	1.39714	1.01714	9.97804
9050.94	1805	1.39715	1.01858	9.97807
9071.55	1810	1.39716	1.02003	9.97809
9092.15	1815	1.39716	1.02148	9.97812
9112.73	1820	1.39717	1.02292	9.97815
9133.3	1825	1.39717	1.02436	9.97818
9153.86	1830	1.39718	1.0258	9.97821
9174.4	1835	1.39718	1.02724	9.97824
9194.93	1840	1.39719	1.02867	9.97826
9215.44	1845	1.39719	1.03011	9.97829
9235.94	1850	1.3972	1.03154	9.97832
9256.42	1855	1.39721	1.03297	9.97835
9276.9	1860	1.39721	1.0344	9.97838
9297.35	1865	1.39722	1.03582	9.9784
9317.8	1870	1.39722	1.03725	9.97843
9338.23	1875	1.39723	1.03867	9.97846
9358.64	1880	1.39723	1.04009	9.97848
9379.04	1885	1.39724	1.04151	9.97851
9399.43	1890	1.39724	1.04293	9.97854
9419.81	1895	1.39725	1.04435	9.97857
9440.17	1900	1.39725	1.04576	9.97859
9460.51	1905	1.39726	1.04717	9.97862
9480.85	1910	1.39726	1.04858	9.97865
9501.17	1915	1.39727	1.04999	9.97867

Iteración Levenberg-Marquardt 3				
9521.47	1920	1.39727	1.0514	9.9787
9541.76	1925	1.39728	1.0528	9.97872
9562.04	1930	1.39728	1.05421	9.97875
9582.31	1935	1.39729	1.05561	9.97878
9602.56	1940	1.39729	1.05701	9.9788
9622.8	1945	1.3973	1.05841	9.97883
9643.02	1950	1.3973	1.05981	9.97885
9663.23	1955	1.39731	1.0612	9.97888
9683.43	1960	1.39731	1.06259	9.9789
9703.62	1965	1.39732	1.06399	9.97893
9723.79	1970	1.39732	1.06538	9.97896
9743.95	1975	1.39733	1.06677	9.97898
9764.09	1980	1.39733	1.06815	9.97901
9784.22	1985	1.39734	1.06954	9.97903
9804.34	1990	1.39734	1.07092	9.97906
9824.45	1995	1.39735	1.0723	9.97908
9844.54	2000	1.39735	1.07368	9.97911
9864.62	2005	1.39736	1.07506	9.97913
9884.68	2010	1.39736	1.07644	9.97915
9904.74	2015	1.39737	1.07782	9.97918
9924.77	2020	1.39737	1.07919	9.9792
9944.8	2025	1.39738	1.08056	9.97923
9964.82	2030	1.39738	1.08193	9.97925
9984.82	2035	1.39739	1.0833	9.97928
10004.8	2040	1.39739	1.08467	9.9793
10024.8	2045	1.3974	1.08604	9.97932

Ilustración 47.- Iteración 4 de Levenberg-Marquardt para Suelo Arcilla.

Tabla 4. Cuarta iteración Levenberg-Marquardt para suelo arcilla

Iteración Levenberg-Marquardt 4					Iteración Levenberg-Marquardt 4					Iteración Levenberg-Marquardt 4				
0	0	0	0	0	636.88	80	1.34002	0.21343	9.80021	1136.16	160	1.37856	0.300374	9.90973
78.613	5	0.759637	0.0508216	78.613	669.389	85	1.34484	0.219871	9.81448	1166.25	165	1.37951	0.304992	9.91244
140.376	10	0.972934	0.0770387	6.54022	701.673	90	1.34912	0.226128	9.82695	1196.24	170	1.38039	0.309542	9.91493
184.741	15	1.08266	0.0944747	8.18701	733.742	95	1.35292	0.232217	9.83792	1226.14	175	1.38119	0.314027	9.91725
216.738	20	1.14969	0.108759	8.79547	765.613	100	1.35632	0.238149	9.84761	1255.94	180	1.38193	0.31845	9.91939
254.452	25	1.19333	0.121208	9.13107	797.298	105	1.35937	0.243938	9.85621	1285.65	185	1.38262	0.322814	9.92138
293.506	30	1.22375	0.132405	9.3296	828.811	110	1.36211	0.249592	9.86389	1315.28	190	1.38325	0.32712	9.92324
330.26	35	1.24663	0.142675	9.45334	860.159	115	1.36457	0.255122	9.87077	1344.82	195	1.38383	0.331371	9.92497
365.508	40	1.26494	0.152222	9.53638	891.352	120	1.36679	0.260535	9.87695	1374.28	200	1.38437	0.335569	9.92658
400.764	45	1.28014	0.161183	9.59727	922.399	125	1.3688	0.265839	9.88252	1403.65	205	1.38487	0.339716	9.9281
435.785	50	1.29296	0.169656	9.64506	953.307	130	1.37062	0.271039	9.88757	1432.95	210	1.38533	0.343815	9.92951
470.202	55	1.30388	0.177716	9.68384	984.082	135	1.37227	0.276143	9.89215	1462.18	215	1.38576	0.347865	9.93085
504.129	60	1.31324	0.185418	9.71577	1014.73	140	1.37377	0.281154	9.89632	1491.33	220	1.38617	0.351871	9.9321
537.761	65	1.32133	0.192808	9.74233	1045.26	145	1.37513	0.286079	9.90012	1520.4	225	1.38654	0.355832	9.93329
571.101	70	1.32839	0.199921	9.76471	1075.67	150	1.37638	0.290921	9.9036	1549.41	230	1.38689	0.35975	9.9344
604.131	75	1.33458	0.206786	9.78378	1105.97	155	1.37752	0.295685	9.9068	1578.35	235	1.38722	0.363627	9.93546

Iteración Levenberg-Marquardt 4				
1607.21	240	1.38752	0.367464	9.93646
1636.02	245	1.38781	0.371263	9.9374
1664.75	250	1.38808	0.375023	9.93831
1693.42	255	1.38834	0.378748	9.93916
1722.03	260	1.38857	0.382436	9.93998
1750.58	265	1.3888	0.386091	9.94076
1779.07	270	1.38901	0.389712	9.9415
1807.5	275	1.38921	0.393301	9.94221
1835.86	280	1.3894	0.396858	9.94289
1864.18	285	1.38958	0.400384	9.94354
1892.43	290	1.38975	0.40388	9.94417
1920.63	295	1.38992	0.407347	9.94477
1948.77	300	1.39007	0.410786	9.94535
1976.86	305	1.39022	0.414197	9.94591
2004.89	310	1.39036	0.417581	9.94644
2032.88	315	1.3905	0.420938	9.94696
2060.81	320	1.39062	0.42427	9.94746
2088.68	325	1.39075	0.427576	9.94794
2116.51	330	1.39087	0.430858	9.94841
2144.29	335	1.39098	0.434116	9.94886
2172.02	340	1.39109	0.43735	9.9493
2199.69	345	1.39119	0.440562	9.94973
2227.32	350	1.39129	0.44375	9.95014
2254.9	355	1.39139	0.446917	9.95054
2282.44	360	1.39148	0.450062	9.95093
2309.93	365	1.39157	0.453186	9.95131
2337.37	370	1.39166	0.45629	9.95168
2364.76	375	1.39175	0.459373	9.95204
2392.11	380	1.39183	0.462436	9.95239
2419.41	385	1.39191	0.46548	9.95273
2446.67	390	1.39198	0.468505	9.95306
2473.89	395	1.39206	0.471511	9.95339
2501.06	400	1.39213	0.474498	9.9537
2528.19	405	1.3922	0.477468	9.95401
2555.27	410	1.39227	0.480419	9.95432
2582.31	415	1.39234	0.483354	9.95461
2609.31	420	1.3924	0.486271	9.9549

Iteración Levenberg-Marquardt 4				
2636.27	425	1.39247	0.489172	9.95519
2663.19	430	1.39253	0.492056	9.95546
2690.06	435	1.39259	0.494924	9.95573
2716.9	440	1.39265	0.497776	9.956
2743.69	445	1.3927	0.500613	9.95626
2770.44	450	1.39276	0.503434	9.95652
2797.16	455	1.39281	0.50624	9.95677
2823.83	460	1.39287	0.509031	9.95701
2850.47	465	1.39292	0.511807	9.95726
2877.06	470	1.39297	0.514569	9.95749
2903.62	475	1.39302	0.517317	9.95773
2930.14	480	1.39307	0.520051	9.95796
2956.62	485	1.39312	0.522771	9.95818
2983.06	490	1.39317	0.525478	9.9584
3009.47	495	1.39321	0.528171	9.95862
3035.83	500	1.39326	0.530851	9.95883
3062.16	505	1.3933	0.533519	9.95904
3088.46	510	1.39335	0.536174	9.95925
3114.72	515	1.39339	0.538816	9.95945
3140.94	520	1.39343	0.541445	9.95965
3167.12	525	1.39347	0.544063	9.95985
3193.27	530	1.39351	0.546669	9.96004
3219.38	535	1.39355	0.549262	9.96023
3245.46	540	1.39359	0.551844	9.96042
3271.51	545	1.39363	0.554415	9.9606
3297.51	550	1.39367	0.556974	9.96079
3323.49	555	1.39371	0.559522	9.96097
3349.43	560	1.39375	0.562059	9.96114
3375.33	565	1.39378	0.564585	9.96132
3401.2	570	1.39382	0.567101	9.96149
3427.04	575	1.39385	0.569605	9.96166
3452.84	580	1.39389	0.5721	9.96183
3478.61	585	1.39392	0.574583	9.96199
3504.35	590	1.39396	0.577057	9.96215
3530.05	595	1.39399	0.579521	9.96231
3555.72	600	1.39402	0.581975	9.96247
3581.36	605	1.39405	0.584418	9.96263

Iteración Levenberg-Marquardt 4				
3606.97	610	1.39409	0.586852	9.96278
3632.54	615	1.39412	0.589277	9.96294
3658.08	620	1.39415	0.591692	9.96309
3683.59	625	1.39418	0.594098	9.96323
3709.07	630	1.39421	0.596494	9.96338
3734.51	635	1.39424	0.598882	9.96353
3759.93	640	1.39427	0.60126	9.96367
3785.31	645	1.3943	0.603629	9.96381
3810.66	650	1.39433	0.60599	9.96395
3835.99	655	1.39435	0.608342	9.96409
3861.28	660	1.39438	0.610685	9.96422
3886.54	665	1.39441	0.61302	9.96436
3911.77	670	1.39444	0.615346	9.96449
3936.96	675	1.39446	0.617664	9.96462
3962.13	680	1.39449	0.619974	9.96475
3987.27	685	1.39452	0.622275	9.96488
4012.38	690	1.39454	0.624569	9.96501
4037.46	695	1.39457	0.626855	9.96513
4062.51	700	1.39459	0.629132	9.96526
4087.53	705	1.39462	0.631402	9.96538
4112.52	710	1.39464	0.633664	9.9655
4137.49	715	1.39467	0.635919	9.96562
4162.42	720	1.39469	0.638166	9.96574
4187.32	725	1.39472	0.640405	9.96585
4212.2	730	1.39474	0.642637	9.96597
4237.05	735	1.39476	0.644862	9.96609
4261.87	740	1.39479	0.647079	9.9662
4286.66	745	1.39481	0.64929	9.96631
4311.42	750	1.39483	0.651493	9.96642
4336.16	755	1.39485	0.653689	9.96653
4360.86	760	1.39488	0.655878	9.96664
4385.54	765	1.3949	0.658061	9.96675
4410.19	770	1.39492	0.660236	9.96686
4434.82	775	1.39494	0.662405	9.96696
4459.41	780	1.39496	0.664567	9.96707
4483.98	785	1.39498	0.666722	9.96717
4508.53	790	1.395	0.668871	9.96727

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Iteración Levenberg-Marquardt 4				
4533.04	795	1.39502	0.671013	9.96738
4557.53	800	1.39504	0.673149	9.96748
4581.99	805	1.39506	0.675279	9.96758
4606.43	810	1.39508	0.677402	9.96767
4630.84	815	1.3951	0.679519	9.96777
4655.22	820	1.39512	0.681629	9.96787
4679.58	825	1.39514	0.683734	9.96797
4703.91	830	1.39516	0.685832	9.96806
4728.21	835	1.39518	0.687925	9.96815
4752.49	840	1.3952	0.690011	9.96825
4776.74	845	1.39522	0.692091	9.96834
4800.97	850	1.39524	0.694166	9.96843
4825.17	855	1.39525	0.696235	9.96852
4849.34	860	1.39527	0.698297	9.96861
4873.49	865	1.39529	0.700355	9.9687
4897.62	870	1.39531	0.702406	9.96879
4921.72	875	1.39533	0.704452	9.96888
4945.79	880	1.39534	0.706492	9.96896
4969.84	885	1.39536	0.708527	9.96905
4993.87	890	1.39538	0.710556	9.96914
5017.87	895	1.3954	0.71258	9.96922
5041.84	900	1.39541	0.714599	9.9693
5065.79	905	1.39543	0.716612	9.96939
5089.72	910	1.39545	0.718619	9.96947
5113.62	915	1.39546	0.720622	9.96955
5137.5	920	1.39548	0.722619	9.96963
5161.35	925	1.39549	0.724611	9.96971
5185.18	930	1.39551	0.726598	9.96979
5208.99	935	1.39553	0.72858	9.96987
5232.77	940	1.39554	0.730557	9.96995
5256.53	945	1.39556	0.732528	9.97003
5280.26	950	1.39557	0.734495	9.97011
5303.97	955	1.39559	0.736457	9.97018
5327.66	960	1.3956	0.738414	9.97026
5351.32	965	1.39562	0.740366	9.97033
5374.96	970	1.39563	0.742313	9.97041
5398.58	975	1.39565	0.744256	9.97048

Iteración Levenberg-Marquardt 4				
5422.17	980	1.39566	0.746194	9.97056
5445.74	985	1.39568	0.748127	9.97063
5469.29	990	1.39569	0.750055	9.9707
5492.81	995	1.39571	0.751979	9.97077
5516.32	1000	1.39572	0.753898	9.97084
5539.8	1005	1.39573	0.755812	9.97092
5563.25	1010	1.39575	0.757722	9.97099
5586.69	1015	1.39576	0.759628	9.97106
5610.1	1020	1.39578	0.761529	9.97112
5633.49	1025	1.39579	0.763425	9.97119
5656.85	1030	1.3958	0.765317	9.97126
5680.2	1035	1.39582	0.767205	9.97133
5703.52	1040	1.39583	0.769088	9.9714
5726.82	1045	1.39584	0.770968	9.97146
5750.1	1050	1.39586	0.772842	9.97153
5773.35	1055	1.39587	0.774713	9.97159
5796.59	1060	1.39588	0.776579	9.97166
5819.8	1065	1.3959	0.778442	9.97172
5842.99	1070	1.39591	0.7803	9.97179
5866.16	1075	1.39592	0.782153	9.97185
5889.31	1080	1.39593	0.784003	9.97192
5912.43	1085	1.39595	0.785849	9.97198
5935.54	1090	1.39596	0.787691	9.97204
5958.62	1095	1.39597	0.789528	9.9721
5981.68	1100	1.39598	0.791362	9.97216
6004.73	1105	1.396	0.793191	9.97223
6027.75	1110	1.39601	0.795017	9.97229
6050.74	1115	1.39602	0.796839	9.97235
6073.72	1120	1.39603	0.798657	9.97241
6096.68	1125	1.39604	0.800471	9.97247
6119.62	1130	1.39606	0.802281	9.97252
6142.53	1135	1.39607	0.804088	9.97258
6165.43	1140	1.39608	0.80589	9.97264
6188.3	1145	1.39609	0.807689	9.9727
6211.15	1150	1.3961	0.809484	9.97276
6233.99	1155	1.39611	0.811276	9.97281
6256.8	1160	1.39612	0.813064	9.97287
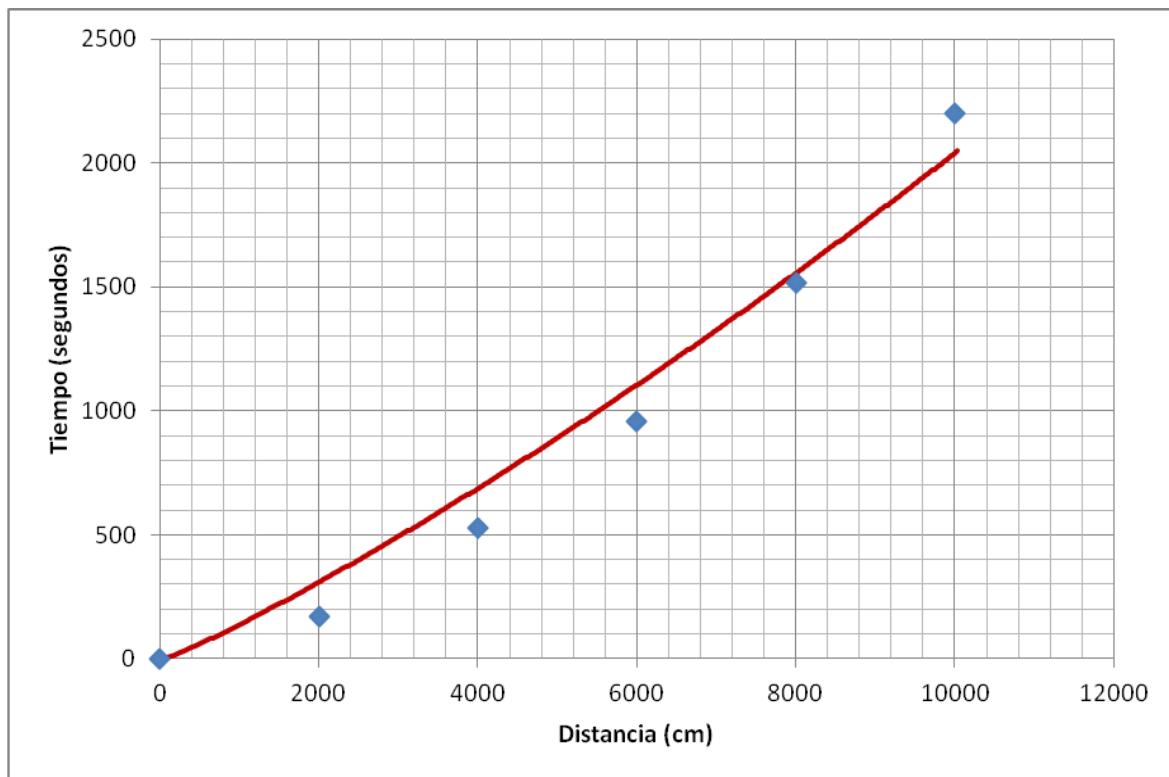
Iteración Levenberg-Marquardt 4				
6279.59	1165	1.39614	0.814848	9.97293
6302.36	1170	1.39615	0.816628	9.97298
6325.12	1175	1.39616	0.818405	9.97304
6347.85	1180	1.39617	0.820178	9.97309
6370.56	1185	1.39618	0.821948	9.97315
6393.25	1190	1.39619	0.823714	9.9732
6415.92	1195	1.3962	0.825477	9.97326
6438.57	1200	1.39621	0.827236	9.97331
6461.21	1205	1.39622	0.828992	9.97337
6483.82	1210	1.39623	0.830744	9.97342
6506.41	1215	1.39624	0.832492	9.97347
6528.98	1220	1.39625	0.834238	9.97352
6551.54	1225	1.39626	0.83598	9.97358
6574.07	1230	1.39627	0.837718	9.97363
6596.58	1235	1.39628	0.839453	9.97368
6619.08	1240	1.39629	0.841185	9.97373
6641.55	1245	1.3963	0.842914	9.97378
6664.01	1250	1.39631	0.844639	9.97383
6686.45	1255	1.39632	0.846361	9.97388
6708.87	1260	1.39633	0.84808	9.97393
6731.26	1265	1.39634	0.849795	9.97398
6753.64	1270	1.39635	0.851508	9.97403
6776	1275	1.39636	0.853217	9.97408
6798.35	1280	1.39637	0.854923	9.97413
6820.67	1285	1.39638	0.856625	9.97418
6842.97	1290	1.39639	0.858325	9.97423
6865.26	1295	1.3964	0.860021	9.97427
6887.53	1300	1.39641	0.861715	9.97432
6909.77	1305	1.39642	0.863405	9.97437
6932	1310	1.39643	0.865092	9.97442
6954.21	1315	1.39644	0.866777	9.97446
6976.41	1320	1.39645	0.868458	9.97451
6998.58	1325	1.39646	0.870136	9.97456
7020.74	1330	1.39647	0.871811	9.9746
7042.87	1335	1.39648	0.873483	9.97465
7064.99	1340	1.39649	0.875152	9.97469
7087.09	1345	1.39649	0.876818	9.97474

Iteración Levenberg-Marquardt 4				
7109.18	1350	1.3965	0.878482	9.97478
7131.24	1355	1.39651	0.880142	9.97483
7153.29	1360	1.39652	0.8818	9.97487
7175.32	1365	1.39653	0.883454	9.97492
7197.33	1370	1.39654	0.885106	9.97496
7219.32	1375	1.39655	0.886755	9.97501
7241.3	1380	1.39656	0.888401	9.97505
7263.25	1385	1.39656	0.890044	9.97509
7285.19	1390	1.39657	0.891684	9.97514
7307.11	1395	1.39658	0.893322	9.97518
7329.02	1400	1.39659	0.894957	9.97522
7350.9	1405	1.3966	0.896589	9.97526
7372.77	1410	1.39661	0.898218	9.97531
7394.63	1415	1.39661	0.899845	9.97535
7416.46	1420	1.39662	0.901468	9.97539
7438.28	1425	1.39663	0.90309	9.97543
7460.08	1430	1.39664	0.904708	9.97547
7481.86	1435	1.39665	0.906324	9.97551
7503.62	1440	1.39666	0.907937	9.97555
7525.37	1445	1.39666	0.909547	9.97559
7547.1	1450	1.39667	0.911155	9.97563
7568.81	1455	1.39668	0.912761	9.97567
7590.51	1460	1.39669	0.914363	9.97571
7612.19	1465	1.39669	0.915963	9.97575
7633.85	1470	1.3967	0.917561	9.97579
7655.5	1475	1.39671	0.919155	9.97583
7677.13	1480	1.39672	0.920748	9.97587
7698.74	1485	1.39673	0.922338	9.97591
7720.33	1490	1.39673	0.923925	9.97595
7741.91	1495	1.39674	0.925509	9.97599
7763.47	1500	1.39675	0.927092	9.97603
7785.02	1505	1.39676	0.928671	9.97606
7806.54	1510	1.39676	0.930249	9.9761
7828.06	1515	1.39677	0.931823	9.97614
7849.55	1520	1.39678	0.933396	9.97618
7871.03	1525	1.39679	0.934966	9.97621
7892.49	1530	1.39679	0.936533	9.97625

Iteración Levenberg-Marquardt 4				
7913.94	1535	1.3968	0.938098	9.97629
7935.37	1540	1.39681	0.939661	9.97633
7956.78	1545	1.39681	0.941221	9.97636
7978.18	1550	1.39682	0.942779	9.9764
7999.56	1555	1.39683	0.944334	9.97644
8020.92	1560	1.39684	0.945887	9.97647
8042.27	1565	1.39684	0.947438	9.97651
8063.6	1570	1.39685	0.948987	9.97654
8084.92	1575	1.39686	0.950533	9.97658
8106.22	1580	1.39686	0.952077	9.97661
8127.51	1585	1.39687	0.953618	9.97665
8148.77	1590	1.39688	0.955157	9.97668
8170.03	1595	1.39689	0.956694	9.97672
8191.26	1600	1.39689	0.958229	9.97675
8212.48	1605	1.3969	0.959761	9.97679
8233.69	1610	1.39691	0.961291	9.97682
8254.88	1615	1.39691	0.962819	9.97686
8276.05	1620	1.39692	0.964345	9.97689
8297.21	1625	1.39693	0.965868	9.97693
8318.35	1630	1.39693	0.967389	9.97696
8339.48	1635	1.39694	0.968908	9.97699
8360.59	1640	1.39695	0.970425	9.97703
8381.69	1645	1.39695	0.97194	9.97706
8402.77	1650	1.39696	0.973452	9.97709
8423.83	1655	1.39697	0.974963	9.97713
8444.88	1660	1.39697	0.976471	9.97716
8465.92	1665	1.39698	0.977977	9.9772
8486.94	1670	1.39698	0.979481	9.97722
8507.94	1675	1.39699	0.980983	9.97726
8528.93	1680	1.397	0.982482	9.97729
8549.9	1685	1.397	0.98398	9.97732
8570.86	1690	1.39701	0.985475	9.97735
8591.8	1695	1.39702	0.986969	9.97738
8612.73	1700	1.39702	0.98846	9.97742
8633.64	1705	1.39703	0.989949	9.97745
8654.54	1710	1.39703	0.991436	9.97748
8675.43	1715	1.39704	0.992922	9.97751

Iteración Levenberg-Marquardt 4				
8696.29	1720	1.39705	0.994405	9.97754
8717.15	1725	1.39705	0.995886	9.97757
8737.99	1730	1.39706	0.997365	9.9776
8758.81	1735	1.39706	0.998842	9.97763
8779.62	1740	1.39707	1.00032	9.97766
8800.41	1745	1.39708	1.00179	9.97769
8821.19	1750	1.39708	1.00326	9.97772
8841.96	1755	1.39709	1.00473	9.97775
8862.71	1760	1.39709	1.0062	9.97779
8883.44	1765	1.3971	1.00766	9.97781
8904.16	1770	1.39711	1.00913	9.97784
8924.87	1775	1.39711	1.01059	9.97787
8945.56	1780	1.39712	1.01205	9.9779
8966.24	1785	1.39712	1.0135	9.97793
8986.9	1790	1.39713	1.01496	9.97796
9007.55	1795	1.39714	1.01641	9.97799
9028.18	1800	1.39714	1.01786	9.97802
9048.8	1805	1.39715	1.01931	9.97805
9069.41	1810	1.39715	1.02076	9.97808
9090	1815	1.39716	1.02221	9.97811
9110.57	1820	1.39716	1.02365	9.97814
9131.14	1825	1.39717	1.02509	9.97816
9151.68	1830	1.39717	1.02653	9.97819
9172.22	1835	1.39718	1.02797	9.97822
9192.74	1840	1.39719	1.02941	9.97825
9213.25	1845	1.39719	1.03084	9.97828
9233.74	1850	1.3972	1.03228	9.9783
9254.22	1855	1.3972	1.03371	9.97833
9274.68	1860	1.39721	1.03514	9.97836
9295.13	1865	1.39721	1.03657	9.97839
9315.57	1870	1.39722	1.03799	9.97841
9335.99	1875	1.39722	1.03942	9.97844
9356.4	1880	1.39723	1.04084	9.97847
9376.79	1885	1.39723	1.04226	9.9785
9397.17	1890	1.39724	1.04368	9.97852
9417.54	1895	1.39724	1.04509	9.97855
9437.89	1900	1.39725	1.04651	9.97858
9458.23	1905	1.39726	1.04792	9.9786

Iteración Levenberg-Marquardt 4				
9478.56	1910	1.39726	1.04933	9.97863
9498.87	1915	1.39727	1.05074	9.97866
9519.17	1920	1.39727	1.05215	9.97868
9539.45	1925	1.39728	1.05356	9.97871
9559.72	1930	1.39728	1.05496	9.97874
9579.98	1935	1.39729	1.05637	9.97876
9600.23	1940	1.39729	1.05777	9.97879
9620.46	1945	1.3973	1.05917	9.97881
9640.67	1950	1.3973	1.06057	9.97884
9660.88	1955	1.39731	1.06196	9.97886
9681.07	1960	1.39731	1.06336	9.97889
9701.25	1965	1.39732	1.06475	9.97892
9721.41	1970	1.39732	1.06614	9.97894
9741.56	1975	1.39733	1.06753	9.97897
9761.7	1980	1.39733	1.06892	9.97899
9781.82	1985	1.39734	1.07031	9.97902
9801.93	1990	1.39734	1.07169	9.97904
9822.03	1995	1.39735	1.07307	9.97907
9842.12	2000	1.39735	1.07445	9.97909
9862.19	2005	1.39736	1.07583	9.97912
9882.25	2010	1.39736	1.07721	9.97914
9902.29	2015	1.39737	1.07859	9.97916
9922.32	2020	1.39737	1.07996	9.97919
9942.34	2025	1.39737	1.08134	9.97921
9962.35	2030	1.39738	1.08271	9.97924
9982.34	2035	1.39738	1.08408	9.97926
10002.3	2040	1.39739	1.08545	9.97929
10022.3	2045	1.39739	1.08682	9.97931

Ilustración 48.- Iteración 5 de Levenberg-Marquardt para Suelo Arcilla.

Tabla 5. Quinta iteración Levenberg-Marquardt para suelo arcilla.

Iteración Levenberg-Marquardt 5					Iteración Levenberg-Marquardt 5					Iteración Levenberg-Marquardt 5				
0	0	0	0	0	636.748	80	1.34	0.213647	9.80044	1135.96	160	1.37854	0.300681	9.9098
78.5031	5	0.75932	0.0508732	78.5031	669.253	85	1.34482	0.220095	9.81469	1166.04	165	1.3795	0.305304	9.9125
140.255	10	0.972708	0.0771167	6.54441	701.533	90	1.34909	0.226359	9.82714	1196.03	170	1.38037	0.309858	9.915
184.629	15	1.08253	0.0945703	8.18892	733.598	95	1.3529	0.232453	9.83809	1225.92	175	1.38118	0.314348	9.9173
216.637	20	1.14962	0.10887	8.79674	765.464	100	1.3563	0.238392	9.84776	1255.71	180	1.38192	0.318776	9.91945
254.35	25	1.19328	0.121331	9.13213	797.145	105	1.35935	0.244187	9.85635	1285.42	185	1.3826	0.323144	9.92144
293.402	30	1.22371	0.13254	9.3305	828.653	110	1.36209	0.249847	9.86402	1315.04	190	1.38323	0.327454	9.92329
330.155	35	1.24659	0.14282	9.4541	859.997	115	1.36455	0.255383	9.87089	1344.57	195	1.38382	0.33171	9.92502
365.401	40	1.26491	0.152377	9.53701	891.186	120	1.36677	0.260801	9.87706	1374.03	200	1.38436	0.335912	9.92663
400.655	45	1.28011	0.161346	9.59782	922.228	125	1.36878	0.26611	9.88263	1403.4	205	1.38486	0.340064	9.92814
435.673	50	1.29293	0.169828	9.64553	953.13	130	1.3706	0.271316	9.88767	1432.69	210	1.38532	0.344166	9.92956
470.087	55	1.30385	0.177896	9.68425	983.901	135	1.37225	0.276424	9.89224	1461.91	215	1.38575	0.348221	9.93089
504.011	60	1.31321	0.185607	9.71613	1014.54	140	1.37375	0.281441	9.8964	1491.05	220	1.38615	0.352231	9.93214
537.64	65	1.32131	0.193004	9.74265	1045.07	145	1.37512	0.286371	9.9002	1520.12	225	1.38653	0.356196	9.93333
570.977	70	1.32837	0.200124	9.76499	1075.47	150	1.37636	0.291218	9.90368	1549.12	230	1.38688	0.360118	9.93444
604.002	75	1.33455	0.206997	9.78404	1105.77	155	1.3775	0.295987	9.90687	1578.05	235	1.38721	0.363999	9.9355

Iteración Levenberg-Marquardt 5				
1606.92	240	1.38751	0.36784	9.93649
1635.71	245	1.3878	0.371643	9.93744
1664.44	250	1.38807	0.375407	9.93834
1693.11	255	1.38832	0.379135	9.9392
1721.71	260	1.38856	0.382828	9.94001
1750.25	265	1.38879	0.386486	9.94079
1778.73	270	1.389	0.390111	9.94153
1807.15	275	1.3892	0.393704	9.94224
1835.52	280	1.38939	0.397264	9.94292
1863.82	285	1.38957	0.400794	9.94357
1892.07	290	1.38974	0.404294	9.9442
1920.26	295	1.38991	0.407765	9.9448
1948.4	300	1.39006	0.411207	9.94538
1976.48	305	1.39021	0.414622	9.94593
2004.51	310	1.39035	0.418009	9.94647
2032.48	315	1.39049	0.42137	9.94699
2060.41	320	1.39061	0.424705	9.94749
2088.28	325	1.39074	0.428015	9.94797
2116.1	330	1.39086	0.4313	9.94844
2143.87	335	1.39097	0.434561	9.94889
2171.59	340	1.39108	0.437799	9.94933
2199.26	345	1.39118	0.441014	9.94975
2226.88	350	1.39128	0.444206	9.95017
2254.46	355	1.39138	0.447376	9.95057
2281.98	360	1.39148	0.450524	9.95096
2309.46	365	1.39157	0.453652	9.95134
2336.9	370	1.39165	0.456758	9.9517
2364.28	375	1.39174	0.459844	9.95206
2391.63	380	1.39182	0.462911	9.95241
2418.92	385	1.3919	0.465958	9.95275
2446.18	390	1.39198	0.468986	9.95309
2473.38	395	1.39205	0.471995	9.95341
2500.55	400	1.39212	0.474985	9.95373
2527.67	405	1.39219	0.477958	9.95404
2554.74	410	1.39226	0.480913	9.95434
2581.78	415	1.39233	0.48385	9.95464
2608.77	420	1.39239	0.486771	9.95493

Iteración Levenberg-Marquardt 5				
2635.72	425	1.39246	0.489675	9.95521
2662.63	430	1.39252	0.492562	9.95549
2689.5	435	1.39258	0.495433	9.95576
2716.33	440	1.39264	0.498288	9.95602
2743.11	445	1.3927	0.501127	9.95628
2769.86	450	1.39275	0.503951	9.95654
2796.56	455	1.39281	0.50676	9.95679
2823.23	460	1.39286	0.509554	9.95704
2849.86	465	1.39291	0.512333	9.95728
2876.45	470	1.39296	0.515098	9.95752
2903	475	1.39301	0.517849	9.95775
2929.51	480	1.39306	0.520586	9.95798
2955.98	485	1.39311	0.523309	9.9582
2982.41	490	1.39316	0.526018	9.95842
3008.81	495	1.39321	0.528715	9.95864
3035.17	500	1.39325	0.531398	9.95885
3061.49	505	1.3933	0.534068	9.95906
3087.78	510	1.39334	0.536725	9.95927
3114.03	515	1.39338	0.53937	9.95947
3140.24	520	1.39343	0.542003	9.95967
3166.42	525	1.39347	0.544623	9.95987
3192.56	530	1.39351	0.547231	9.96006
3218.67	535	1.39355	0.549828	9.96025
3244.74	540	1.39359	0.552412	9.96044
3270.77	545	1.39363	0.554986	9.96062
3296.77	550	1.39366	0.557548	9.96081
3322.74	555	1.3937	0.560098	9.96099
3348.67	560	1.39374	0.562638	9.96116
3374.57	565	1.39378	0.565167	9.96134
3400.43	570	1.39381	0.567685	9.96151
3426.26	575	1.39385	0.570192	9.96168
3452.06	580	1.39388	0.572689	9.96185
3477.82	585	1.39392	0.575175	9.96201
3503.55	590	1.39395	0.577652	9.96217
3529.24	595	1.39398	0.580118	9.96233
3554.9	600	1.39402	0.582574	9.96249
3580.53	605	1.39405	0.585021	9.96265

Iteración Levenberg-Marquardt 5				
3606.13	610	1.39408	0.587457	9.9628
3631.7	615	1.39411	0.589884	9.96295
3657.23	620	1.39414	0.592302	9.9631
3682.73	625	1.39417	0.59471	9.96325
3708.2	630	1.3942	0.597109	9.9634
3733.64	635	1.39423	0.599499	9.96354
3759.04	640	1.39426	0.60188	9.96369
3784.42	645	1.39429	0.604252	9.96383
3809.76	650	1.39432	0.606615	9.96397
3835.07	655	1.39435	0.608969	9.9641
3860.36	660	1.39438	0.611315	9.96424
3885.61	665	1.3944	0.613652	9.96437
3910.83	670	1.39443	0.615981	9.96451
3936.02	675	1.39446	0.618301	9.96464
3961.18	680	1.39448	0.620613	9.96477
3986.31	685	1.39451	0.622917	9.9649
4011.41	690	1.39454	0.625213	9.96502
4036.48	695	1.39456	0.627501	9.96515
4061.52	700	1.39459	0.629781	9.96527
4086.54	705	1.39461	0.632053	9.96539
4111.52	710	1.39464	0.634318	9.96552
4136.47	715	1.39466	0.636575	9.96564
4161.4	720	1.39469	0.638824	9.96575
4186.29	725	1.39471	0.641066	9.96587
4211.16	730	1.39473	0.6433	9.96599
4236	735	1.39476	0.645528	9.9661
4260.81	740	1.39478	0.647747	9.96622
4285.59	745	1.3948	0.64996	9.96633
4310.35	750	1.39482	0.652166	9.96644
4335.07	755	1.39485	0.654364	9.96655
4359.77	760	1.39487	0.656556	9.96666
4384.44	765	1.39489	0.65874	9.96677
4409.08	770	1.39491	0.660918	9.96687
4433.7	775	1.39493	0.663089	9.96698
4458.29	780	1.39496	0.665253	9.96708
4482.85	785	1.39498	0.667411	9.96719
4507.38	790	1.395	0.669562	9.96729

Iteración Levenberg-Marquardt 5				
4531.89	795	1.39502	0.671706	9.96739
4556.37	800	1.39504	0.673845	9.96749
4580.82	805	1.39506	0.675976	9.96759
4605.25	810	1.39508	0.678102	9.96769
4629.65	815	1.3951	0.680221	9.96779
4654.02	820	1.39512	0.682334	9.96789
4678.37	825	1.39514	0.68444	9.96798
4702.69	830	1.39516	0.686541	9.96808
4726.99	835	1.39517	0.688635	9.96817
4751.25	840	1.39519	0.690724	9.96826
4775.5	845	1.39521	0.692807	9.96836
4799.72	850	1.39523	0.694883	9.96845
4823.91	855	1.39525	0.696954	9.96854
4848.07	860	1.39527	0.699019	9.96863
4872.21	865	1.39529	0.701079	9.96872
4896.33	870	1.3953	0.703132	9.96881
4920.42	875	1.39532	0.70518	9.96889
4944.49	880	1.39534	0.707223	9.96898
4968.53	885	1.39536	0.70926	9.96907
4992.54	890	1.39537	0.711291	9.96915
5016.53	895	1.39539	0.713317	9.96924
5040.5	900	1.39541	0.715338	9.96932
5064.44	905	1.39542	0.717353	9.9694
5088.36	910	1.39544	0.719363	9.96949
5112.25	915	1.39546	0.721367	9.96957
5136.12	920	1.39547	0.723367	9.96965
5159.96	925	1.39549	0.725361	9.96973
5183.78	930	1.3955	0.72735	9.96981
5207.58	935	1.39552	0.729334	9.96989
5231.35	940	1.39554	0.731313	9.96997
5255.1	945	1.39555	0.733286	9.97004
5278.83	950	1.39557	0.735255	9.97012
5302.53	955	1.39558	0.737219	9.9702
5326.2	960	1.3956	0.739178	9.97027
5349.86	965	1.39561	0.741132	9.97035
5373.49	970	1.39563	0.743082	9.97042
5397.1	975	1.39564	0.745026	9.9705
5420.68	980	1.39566	0.746966	9.97057
5444.24	985	1.39567	0.748901	9.97064
5467.78	990	1.39569	0.750831	9.97072
5491.3	995	1.3957	0.752757	9.97079
5514.79	1000	1.39571	0.754678	9.97086
5538.26	1005	1.39573	0.756595	9.97093
5561.7	1010	1.39574	0.758507	9.971
5585.13	1015	1.39576	0.760414	9.97107
5608.53	1020	1.39577	0.762317	9.97114
5631.91	1025	1.39578	0.764216	9.97121
5655.27	1030	1.3958	0.76611	9.97127
5678.6	1035	1.39581	0.768	9.97134
5701.92	1040	1.39583	0.769885	9.97141
5725.21	1045	1.39584	0.771766	9.97148
5748.47	1050	1.39585	0.773643	9.97154
5771.72	1055	1.39586	0.775516	9.97161
5794.95	1060	1.39588	0.777384	9.97167
5818.15	1065	1.39589	0.779248	9.97174
5841.33	1070	1.3959	0.781108	9.9718
5864.49	1075	1.39592	0.782964	9.97187
5887.63	1080	1.39593	0.784816	9.97193
5910.74	1085	1.39594	0.786663	9.97199
5933.84	1090	1.39595	0.788507	9.97205
5956.91	1095	1.39597	0.790346	9.97212
5979.97	1100	1.39598	0.792182	9.97218
6003	1105	1.39599	0.794014	9.97224
6026.01	1110	1.396	0.795841	9.9723
6049	1115	1.39601	0.797665	9.97236
6071.97	1120	1.39603	0.799485	9.97242
6094.91	1125	1.39604	0.801301	9.97248
6117.84	1130	1.39605	0.803113	9.97254
6140.74	1135	1.39606	0.804921	9.9726
6163.63	1140	1.39607	0.806726	9.97265
6186.49	1145	1.39609	0.808527	9.97271
6209.34	1150	1.3961	0.810324	9.97277
6232.16	1155	1.39611	0.812117	9.97283
6254.96	1160	1.39612	0.813907	9.97288
6277.75	1165	1.39613	0.815693	9.97294
6300.51	1170	1.39614	0.817475	9.973
6323.25	1175	1.39615	0.819254	9.97305
6345.97	1180	1.39616	0.821029	9.97311
6368.68	1185	1.39617	0.822801	9.97316
6391.36	1190	1.39619	0.824569	9.97322
6414.02	1195	1.3962	0.826333	9.97327
6436.66	1200	1.39621	0.828094	9.97332
6459.28	1205	1.39622	0.829852	9.97338
6481.89	1210	1.39623	0.831606	9.97343
6504.47	1215	1.39624	0.833356	9.97348
6527.03	1220	1.39625	0.835103	9.97354
6549.57	1225	1.39626	0.836847	9.97359
6572.1	1230	1.39627	0.838588	9.97364
6594.6	1235	1.39628	0.840325	9.97369
6617.09	1240	1.39629	0.842058	9.97374
6639.55	1245	1.3963	0.843789	9.97379
6662	1250	1.39631	0.845516	9.97385
6684.43	1255	1.39632	0.84724	9.9739
6706.83	1260	1.39633	0.84896	9.97395
6729.22	1265	1.39634	0.850678	9.974
6751.59	1270	1.39635	0.852392	9.97404
6773.94	1275	1.39636	0.854103	9.97409
6796.28	1280	1.39637	0.85581	9.97414
6818.59	1285	1.39638	0.857515	9.97419
6840.88	1290	1.39639	0.859216	9.97424
6863.16	1295	1.3964	0.860915	9.97429
6885.42	1300	1.39641	0.86261	9.97433
6907.65	1305	1.39642	0.864302	9.97438
6929.87	1310	1.39643	0.865991	9.97443
6952.07	1315	1.39644	0.867677	9.97448
6974.26	1320	1.39644	0.86936	9.97452
6996.42	1325	1.39645	0.87104	9.97457
7018.57	1330	1.39646	0.872716	9.97461
7040.69	1335	1.39647	0.87439	9.97466
7062.8	1340	1.39648	0.876061	9.97471
7084.89	1345	1.39649	0.877729	9.97475

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Iteración Levenberg-Marquardt 5					Iteración Levenberg-Marquardt 5					Iteración Levenberg-Marquardt 5				
7106.97	1350	1.3965	0.879394	9.9748	7911.35	1535	1.3968	0.939074	9.9763	8693.32	1720	1.39704	0.995441	9.97755
7129.02	1355	1.39651	0.881056	9.97484	7932.77	1540	1.3968	0.940639	9.97634	8714.16	1725	1.39705	0.996924	9.97758
7151.06	1360	1.39652	0.882716	9.97489	7954.17	1545	1.39681	0.942201	9.97637	8734.99	1730	1.39705	0.998404	9.97761
7173.08	1365	1.39653	0.884372	9.97493	7975.56	1550	1.39682	0.94376	9.97641	8755.81	1735	1.39706	0.999883	9.97764
7195.08	1370	1.39653	0.886026	9.97497	7996.93	1555	1.39682	0.945317	9.97645	8776.6	1740	1.39707	1.00136	9.97767
7217.06	1375	1.39654	0.887676	9.97502	8018.29	1560	1.39683	0.946872	9.97648	8797.39	1745	1.39707	1.00283	9.9777
7239.02	1380	1.39655	0.889324	9.97506	8039.62	1565	1.39684	0.948424	9.97652	8818.16	1750	1.39708	1.00431	9.97774
7260.97	1385	1.39656	0.890969	9.9751	8060.95	1570	1.39685	0.949974	9.97655	8838.91	1755	1.39708	1.00578	9.97777
7282.9	1390	1.39657	0.892611	9.97515	8082.25	1575	1.39685	0.951522	9.97659	8859.65	1760	1.39709	1.00725	9.9778
7304.81	1395	1.39658	0.89425	9.97519	8103.54	1580	1.39686	0.953068	9.97663	8880.37	1765	1.3971	1.00871	9.97783
7326.71	1400	1.39659	0.895887	9.97523	8124.82	1585	1.39687	0.954611	9.97666	8901.08	1770	1.3971	1.01018	9.97786
7348.58	1405	1.39659	0.897521	9.97527	8146.07	1590	1.39687	0.956152	9.9767	8921.78	1775	1.39711	1.01164	9.97788
7370.44	1410	1.3966	0.899152	9.97532	8167.32	1595	1.39688	0.95769	9.97673	8942.46	1780	1.39711	1.0131	9.97791
7392.28	1415	1.39661	0.90078	9.97536	8188.54	1600	1.39689	0.959226	9.97676	8963.13	1785	1.39712	1.01456	9.97794
7414.11	1420	1.39662	0.902406	9.9754	8209.75	1605	1.39689	0.96076	9.9768	8983.78	1790	1.39713	1.01602	9.97797
7435.91	1425	1.39663	0.904028	9.97544	8230.95	1610	1.3969	0.962292	9.97683	9004.42	1795	1.39713	1.01747	9.978
7457.7	1430	1.39663	0.905649	9.97548	8252.13	1615	1.39691	0.963822	9.97687	9025.04	1800	1.39714	1.01893	9.97803
7479.47	1435	1.39664	0.907266	9.97552	8273.29	1620	1.39691	0.965349	9.9769	9045.65	1805	1.39714	1.02038	9.97806
7501.23	1440	1.39665	0.908881	9.97556	8294.44	1625	1.39692	0.966874	9.97694	9066.24	1810	1.39715	1.02183	9.97809
7522.97	1445	1.39666	0.910493	9.97561	8315.57	1630	1.39693	0.968397	9.97697	9086.83	1815	1.39715	1.02327	9.97812
7544.69	1450	1.39667	0.912103	9.97565	8336.69	1635	1.39693	0.969918	9.977	9107.39	1820	1.39716	1.02472	9.97815
7566.39	1455	1.39667	0.91371	9.97569	8357.79	1640	1.39694	0.971436	9.97704	9127.94	1825	1.39717	1.02616	9.97817
7588.08	1460	1.39668	0.915314	9.97573	8378.87	1645	1.39695	0.972952	9.97707	9148.48	1830	1.39717	1.02761	9.9782
7609.75	1465	1.39669	0.916916	9.97577	8399.94	1650	1.39695	0.974466	9.9771	9169	1835	1.39718	1.02905	9.97823
7631.4	1470	1.3967	0.918515	9.9758	8421	1655	1.39696	0.975978	9.97714	9189.51	1840	1.39718	1.03048	9.97826
7653.03	1475	1.39671	0.920111	9.97584	8442.04	1660	1.39697	0.977488	9.97717	9210.01	1845	1.39719	1.03192	9.97829
7674.65	1480	1.39671	0.921705	9.97588	8463.06	1665	1.39697	0.978996	9.9772	9230.49	1850	1.39719	1.03335	9.97831
7696.25	1485	1.39672	0.923297	9.97592	8484.07	1670	1.39698	0.980501	9.97723	9250.96	1855	1.3972	1.03479	9.97834
7717.84	1490	1.39673	0.924886	9.97596	8505.06	1675	1.39699	0.982005	9.97727	9271.41	1860	1.3972	1.03622	9.97837
7739.41	1495	1.39674	0.926472	9.976	8526.04	1680	1.39699	0.983506	9.9773	9291.85	1865	1.39721	1.03765	9.9784
7760.96	1500	1.39674	0.928056	9.97604	8547	1685	1.397	0.985005	9.97733	9312.28	1870	1.39721	1.03907	9.97842
7782.49	1505	1.39675	0.929638	9.97608	8567.95	1690	1.39701	0.986502	9.97736	9332.69	1875	1.39722	1.0405	9.97845
7804.01	1510	1.39676	0.931216	9.97611	8588.88	1695	1.39701	0.987997	9.97739	9353.09	1880	1.39723	1.04192	9.97848
7825.51	1515	1.39677	0.932793	9.97615	8609.8	1700	1.39702	0.98949	9.97743	9373.47	1885	1.39723	1.04335	9.97851
7847	1520	1.39677	0.934367	9.97619	8630.7	1705	1.39702	0.990981	9.97746	9393.84	1890	1.39724	1.04477	9.97853
7868.46	1525	1.39678	0.935939	9.97623	8651.59	1710	1.39703	0.99247	9.97749	9414.2	1895	1.39724	1.04618	9.97856
7889.92	1530	1.39679	0.937508	9.97626	8672.46	1715	1.39704	0.993956	9.97752	9434.54	1900	1.39725	1.0476	9.97859

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Iteración Levenberg-Marquardt 5				
9454.87	1905	1.39725	1.04902	9.97861
9475.18	1910	1.39726	1.05043	9.97864
9495.48	1915	1.39726	1.05184	9.97867
9515.77	1920	1.39727	1.05325	9.97869
9536.05	1925	1.39727	1.05466	9.97872
9556.31	1930	1.39728	1.05607	9.97875
9576.55	1935	1.39728	1.05747	9.97877
9596.79	1940	1.39729	1.05887	9.9788
9617.01	1945	1.39729	1.06027	9.97882
9637.21	1950	1.3973	1.06167	9.97885
9657.41	1955	1.3973	1.06307	9.97887
9677.59	1960	1.39731	1.06447	9.9789
9697.75	1965	1.39731	1.06586	9.97892
9717.91	1970	1.39732	1.06725	9.97895
9738.05	1975	1.39732	1.06865	9.97898
9758.17	1980	1.39733	1.07004	9.979
9778.29	1985	1.39733	1.07142	9.97903
9798.39	1990	1.39734	1.07281	9.97905
9818.48	1995	1.39734	1.07419	9.97908
9838.55	2000	1.39735	1.07558	9.9791
9858.61	2005	1.39735	1.07696	9.97912
9878.66	2010	1.39736	1.07834	9.97915
9898.69	2015	1.39736	1.07972	9.97917
9918.71	2020	1.39737	1.08109	9.9792
9938.72	2025	1.39737	1.08247	9.97922
9958.72	2030	1.39738	1.08384	9.97925
9978.7	2035	1.39738	1.08521	9.97927
9998.67	2040	1.39739	1.08658	9.97929
10018.6	2045	1.39739	1.08795	9.97932
10038.6	2050	1.39739	1.08932	9.97934

Ilustración 49.- Iteración 6 de Levenberg-Marquardt para Suelo Arcilla.

Tabla 6. Sexta iteración Levenberg-Marquardt para suelo arcilla.

Iteración Levenberg-Marquardt 6					Iteración Levenberg-Marquardt 6					Iteración Levenberg-Marquardt 6				
0	0	0	0	0	603.943	75	1.33453	0.207211	9.78394	1075.34	150	1.37635	0.29152	9.9036
78.4994	5	0.759314	0.0509257	78.4994	636.684	80	1.33998	0.213868	9.80034	1105.63	155	1.37748	0.296294	9.90679
140.247	10	0.9727	0.0771962	6.54423	669.184	85	1.3448	0.220323	9.81459	1135.81	160	1.37853	0.300993	9.90973
184.616	15	1.08252	0.0946679	8.1888	701.459	90	1.34907	0.226593	9.82705	1165.89	165	1.37948	0.30562	9.91243
216.622	20	1.1496	0.108982	8.79662	733.52	95	1.35288	0.232694	9.83799	1195.87	170	1.38036	0.31018	9.91492
254.332	25	1.19326	0.121456	9.13201	765.381	100	1.35629	0.238639	9.84767	1225.75	175	1.38116	0.314674	9.91723
293.379	30	1.22369	0.132677	9.33038	797.057	105	1.35933	0.244439	9.85627	1255.55	180	1.3819	0.319107	9.91938
330.128	35	1.24657	0.142968	9.45398	828.56	110	1.36207	0.250106	9.86393	1285.25	185	1.38259	0.323479	9.92137
365.371	40	1.26489	0.152534	9.53689	859.899	115	1.36453	0.255647	9.8708	1314.86	190	1.38322	0.327794	9.92322
400.621	45	1.28009	0.161513	9.5977	891.083	120	1.36675	0.261071	9.87698	1344.39	195	1.3838	0.332054	9.92495
435.635	50	1.29291	0.170004	9.64542	922.119	125	1.36876	0.266386	9.88255	1373.83	200	1.38434	0.336261	9.92656
470.045	55	1.30383	0.17808	9.68414	953.017	130	1.37058	0.271597	9.88759	1403.2	205	1.38484	0.340417	9.92808
503.965	60	1.31319	0.185798	9.71602	983.782	135	1.37223	0.276711	9.89216	1432.49	210	1.38531	0.344524	9.92949
537.589	65	1.32129	0.193203	9.74255	1014.42	140	1.37373	0.281733	9.89632	1461.7	215	1.38574	0.348583	9.93083
570.922	70	1.32835	0.200331	9.76489	1044.94	145	1.3751	0.286668	9.90013	1490.84	220	1.38614	0.352597	9.93208

Iteración Levenberg-Marquardt 6				
1519.9	225	1.38652	0.356566	9.93326
1548.9	230	1.38687	0.360493	9.93438
1577.82	235	1.38719	0.364378	9.93543
1606.68	240	1.3875	0.368223	9.93643
1635.46	245	1.38779	0.372029	9.93738
1664.19	250	1.38806	0.375798	9.93828
1692.85	255	1.38831	0.37953	9.93914
1721.44	260	1.38855	0.383226	9.93995
1749.98	265	1.38878	0.386888	9.94073
1778.45	270	1.38899	0.390517	9.94148
1806.87	275	1.38919	0.394113	9.94219
1835.22	280	1.38938	0.397678	9.94287
1863.52	285	1.38956	0.401211	9.94352
1891.76	290	1.38973	0.404715	9.94414
1919.95	295	1.3899	0.408189	9.94475
1948.08	300	1.39005	0.411635	9.94532
1976.15	305	1.3902	0.415053	9.94588
2004.17	310	1.39034	0.418444	9.94642
2032.14	315	1.39047	0.421809	9.94694
2060.06	320	1.3906	0.425147	9.94744
2087.92	325	1.39073	0.428461	9.94792
2115.74	330	1.39085	0.431749	9.94839
2143.5	335	1.39096	0.435014	9.94884
2171.21	340	1.39107	0.438255	9.94928
2198.88	345	1.39117	0.441473	9.9497
2226.49	350	1.39127	0.444669	9.95012
2254.06	355	1.39137	0.447842	9.95052
2281.58	360	1.39146	0.450994	9.95091
2309.05	365	1.39156	0.454124	9.95129
2336.48	370	1.39164	0.457234	9.95166
2363.86	375	1.39173	0.460324	9.95202
2391.19	380	1.39181	0.463393	9.95237
2418.48	385	1.39189	0.466444	9.95271
2445.73	390	1.39197	0.469475	9.95304
2472.93	395	1.39204	0.472487	9.95336
2500.08	400	1.39211	0.475481	9.95368
2527.2	405	1.39218	0.478457	9.95399

Iteración Levenberg-Marquardt 6				
2554.27	410	1.39225	0.481415	9.95429
2581.29	415	1.39232	0.484355	9.95459
2608.28	420	1.39239	0.487279	9.95488
2635.22	425	1.39245	0.490185	9.95516
2662.12	430	1.39251	0.493076	9.95544
2688.98	435	1.39257	0.49595	9.95571
2715.8	440	1.39263	0.498808	9.95598
2742.58	445	1.39269	0.50165	9.95624
2769.32	450	1.39274	0.504477	9.9565
2796.02	455	1.3928	0.507289	9.95675
2822.68	460	1.39285	0.510086	9.95699
2849.3	465	1.3929	0.512868	9.95723
2875.88	470	1.39296	0.515636	9.95747
2902.42	475	1.39301	0.51839	9.95771
2928.92	480	1.39306	0.521129	9.95793
2955.39	485	1.3931	0.523855	9.95816
2981.81	490	1.39315	0.526568	9.95838
3008.2	495	1.3932	0.529267	9.9586
3034.56	500	1.39324	0.531953	9.95881
3060.87	505	1.39329	0.534626	9.95902
3087.15	510	1.39333	0.537286	9.95923
3113.39	515	1.39337	0.539934	9.95943
3139.6	520	1.39342	0.542569	9.95963
3165.77	525	1.39346	0.545192	9.95983
3191.9	530	1.3935	0.547803	9.96002
3218	535	1.39354	0.550402	9.96021
3244.06	540	1.39358	0.55299	9.9604
3270.09	545	1.39362	0.555566	9.96058
3296.08	550	1.39366	0.55813	9.96077
3322.04	555	1.39369	0.560684	9.96095
3347.96	560	1.39373	0.563226	9.96112
3373.85	565	1.39377	0.565758	9.9613
3399.7	570	1.3938	0.568278	9.96147
3425.52	575	1.39384	0.570788	9.96164
3451.31	580	1.39387	0.573288	9.96181
3477.06	585	1.39391	0.575777	9.96197
3502.78	590	1.39394	0.578256	9.96213

Iteración Levenberg-Marquardt 6				
3528.47	595	1.39397	0.580725	9.96229
3554.12	600	1.39401	0.583183	9.96245
3579.75	605	1.39404	0.585632	9.96261
3605.33	610	1.39407	0.588072	9.96276
3630.89	615	1.3941	0.590501	9.96292
3656.42	620	1.39413	0.592922	9.96307
3681.91	625	1.39416	0.595332	9.96321
3707.37	630	1.3942	0.597734	9.96336
3732.8	635	1.39422	0.600126	9.96351
3758.2	640	1.39425	0.60251	9.96365
3783.56	645	1.39428	0.604884	9.96379
3808.9	650	1.39431	0.60725	9.96393
3834.2	655	1.39434	0.609607	9.96407
3859.47	660	1.39437	0.611955	9.9642
3884.72	665	1.3944	0.614294	9.96434
3909.93	670	1.39442	0.616626	9.96447
3935.11	675	1.39445	0.618949	9.9646
3960.26	680	1.39448	0.621263	9.96473
3985.39	685	1.3945	0.62357	9.96486
4010.48	690	1.39453	0.625868	9.96499
4035.54	695	1.39455	0.628158	9.96511
4060.57	700	1.39458	0.630441	9.96524
4085.58	705	1.3946	0.632716	9.96536
4110.55	710	1.39463	0.634982	9.96548
4135.5	715	1.39465	0.637242	9.9656
4160.41	720	1.39468	0.639493	9.96572
4185.3	725	1.3947	0.641738	9.96584
4210.16	730	1.39473	0.643975	9.96595
4234.99	735	1.39475	0.646204	9.96607
4259.79	740	1.39477	0.648426	9.96618
4284.56	745	1.3948	0.650641	9.96629
4309.31	750	1.39482	0.652849	9.96641
4334.02	755	1.39484	0.65505	9.96652
4358.71	760	1.39486	0.657244	9.96663
4383.37	765	1.39488	0.659431	9.96673
4408.01	770	1.39491	0.661611	9.96684
4432.62	775	1.39493	0.663784	9.96695

Iteración Levenberg-Marquardt 6				
4457.19	780	1.39495	0.665951	9.96705
4481.75	785	1.39497	0.668111	9.96715
4506.27	790	1.39499	0.670264	9.96726
4530.77	795	1.39501	0.672411	9.96736
4555.24	800	1.39503	0.674551	9.96746
4579.68	805	1.39505	0.676685	9.96756
4604.1	810	1.39507	0.678813	9.96766
4628.49	815	1.39509	0.680934	9.96776
4652.86	820	1.39511	0.683049	9.96785
4677.19	825	1.39513	0.685158	9.96795
4701.51	830	1.39515	0.687261	9.96804
4725.79	835	1.39517	0.689358	9.96814
4750.05	840	1.39519	0.691449	9.96823
4774.29	845	1.39521	0.693534	9.96832
4798.49	850	1.39522	0.695612	9.96842
4822.68	855	1.39524	0.697686	9.96851
4846.83	860	1.39526	0.699753	9.9686
4870.97	865	1.39528	0.701814	9.96869
4895.07	870	1.3953	0.70387	9.96877
4919.15	875	1.39531	0.705921	9.96886
4943.21	880	1.39533	0.707965	9.96895
4967.24	885	1.39535	0.710004	9.96903
4991.25	890	1.39537	0.712038	9.96912
5015.23	895	1.39538	0.714066	9.9692
5039.19	900	1.3954	0.716089	9.96929
5063.12	905	1.39542	0.718106	9.96937
5087.03	910	1.39543	0.720118	9.96945
5110.91	915	1.39545	0.722125	9.96954
5134.77	920	1.39547	0.724126	9.96962
5158.6	925	1.39548	0.726123	9.9697
5182.41	930	1.3955	0.728114	9.96978
5206.2	935	1.39551	0.7301	9.96986
5229.96	940	1.39553	0.732081	9.96993
5253.7	945	1.39555	0.734057	9.97001
5277.42	950	1.39556	0.736028	9.97009
5301.11	955	1.39558	0.737994	9.97017
5324.78	960	1.39559	0.739955	9.97024

Iteración Levenberg-Marquardt 6				
5348.42	965	1.39561	0.741911	9.97032
5372.04	970	1.39562	0.743862	9.97039
5395.64	975	1.39564	0.745809	9.97047
5419.22	980	1.39565	0.747751	9.97054
5442.77	985	1.39567	0.749688	9.97061
5466.3	990	1.39568	0.75162	9.97069
5489.8	995	1.39569	0.753548	9.97076
5513.28	1000	1.39571	0.755471	9.97083
5536.74	1005	1.39572	0.75739	9.9709
5560.18	1010	1.39574	0.759304	9.97097
5583.6	1015	1.39575	0.761214	9.97104
5606.99	1020	1.39576	0.763119	9.97111
5630.36	1025	1.39578	0.765019	9.97118
5653.71	1030	1.39579	0.766915	9.97125
5677.03	1035	1.39581	0.768807	9.97131
5700.33	1040	1.39582	0.770695	9.97138
5723.62	1045	1.39583	0.772578	9.97145
5746.87	1050	1.39585	0.774457	9.97151
5770.11	1055	1.39586	0.776331	9.97158
5793.33	1060	1.39587	0.778202	9.97164
5816.52	1065	1.39588	0.780068	9.97171
5839.69	1070	1.3959	0.78193	9.97177
5862.84	1075	1.39591	0.783787	9.97184
5885.97	1080	1.39592	0.785641	9.9719
5909.08	1085	1.39594	0.787491	9.97196
5932.16	1090	1.39595	0.789336	9.97203
5955.23	1095	1.39596	0.791178	9.97209
5978.27	1100	1.39597	0.793015	9.97215
6001.29	1105	1.39598	0.794849	9.97221
6024.29	1110	1.396	0.796679	9.97227
6047.27	1115	1.39601	0.798504	9.97233
6070.23	1120	1.39602	0.800326	9.97239
6093.17	1125	1.39603	0.802144	9.97245
6116.08	1130	1.39604	0.803958	9.97251
6138.98	1135	1.39606	0.805769	9.97257
6161.85	1140	1.39607	0.807575	9.97263
6184.71	1145	1.39608	0.809378	9.97268

Iteración Levenberg-Marquardt 6				
6207.54	1150	1.39609	0.811177	9.97274
6230.36	1155	1.3961	0.812972	9.9728
6253.15	1160	1.39611	0.814764	9.97286
6275.92	1165	1.39612	0.816552	9.97291
6298.67	1170	1.39614	0.818336	9.97297
6321.41	1175	1.39615	0.820117	9.97302
6344.12	1180	1.39616	0.821894	9.97308
6366.81	1185	1.39617	0.823667	9.97313
6389.48	1190	1.39618	0.825437	9.97319
6412.13	1195	1.39619	0.827203	9.97324
6434.77	1200	1.3962	0.828966	9.9733
6457.38	1205	1.39621	0.830726	9.97335
6479.97	1210	1.39622	0.832482	9.9734
6502.54	1215	1.39623	0.834234	9.97346
6525.1	1220	1.39624	0.835983	9.97351
6547.63	1225	1.39625	0.837729	9.97356
6570.14	1230	1.39626	0.839471	9.97361
6592.64	1235	1.39627	0.84121	9.97367
6615.11	1240	1.39628	0.842946	9.97372
6637.57	1245	1.39629	0.844678	9.97377
6660	1250	1.3963	0.846407	9.97382
6682.42	1255	1.39631	0.848132	9.97387
6704.82	1260	1.39632	0.849855	9.97392
6727.2	1265	1.39633	0.851574	9.97397
6749.56	1270	1.39634	0.85329	9.97402
6771.9	1275	1.39635	0.855003	9.97407
6794.22	1280	1.39636	0.856712	9.97412
6816.52	1285	1.39637	0.858419	9.97416
6838.81	1290	1.39638	0.860122	9.97421
6861.07	1295	1.39639	0.861822	9.97426
6883.32	1300	1.3964	0.863519	9.97431
6905.55	1305	1.39641	0.865213	9.97436
6927.76	1310	1.39642	0.866904	9.9744
6949.95	1315	1.39643	0.868592	9.97445
6972.12	1320	1.39644	0.870276	9.9745
6994.27	1325	1.39645	0.871958	9.97454
7016.41	1330	1.39646	0.873637	9.97459

Iteración Levenberg-Marquardt 6				
7038.53	1335	1.39647	0.875312	9.97463
7060.62	1340	1.39648	0.876985	9.97468
7082.71	1345	1.39648	0.878655	9.97473
7104.77	1350	1.39649	0.880322	9.97477
7126.81	1355	1.3965	0.881986	9.97482
7148.84	1360	1.39651	0.883647	9.97486
7170.85	1365	1.39652	0.885305	9.9749
7192.84	1370	1.39653	0.88696	9.97495
7214.81	1375	1.39654	0.888613	9.97499
7236.76	1380	1.39655	0.890262	9.97504
7258.7	1385	1.39655	0.891909	9.97508
7280.62	1390	1.39656	0.893553	9.97512
7302.52	1395	1.39657	0.895194	9.97516
7324.41	1400	1.39658	0.896832	9.97521
7346.27	1405	1.39659	0.898468	9.97525
7368.12	1410	1.3966	0.900101	9.97529
7389.95	1415	1.3966	0.901731	9.97533
7411.76	1420	1.39661	0.903358	9.97537
7433.56	1425	1.39662	0.904983	9.97542
7455.34	1430	1.39663	0.906605	9.97546
7477.1	1435	1.39664	0.908224	9.9755
7498.85	1440	1.39665	0.90984	9.97554
7520.57	1445	1.39665	0.911454	9.97558
7542.28	1450	1.39666	0.913066	9.97562
7563.98	1455	1.39667	0.914674	9.97566
7585.65	1460	1.39668	0.91628	9.9757
7607.31	1465	1.39669	0.917884	9.97574
7628.95	1470	1.39669	0.919485	9.97578
7650.58	1475	1.3967	0.921083	9.97582
7672.18	1480	1.39671	0.922679	9.97586
7693.78	1485	1.39672	0.924272	9.9759
7715.35	1490	1.39672	0.925863	9.97594
7736.91	1495	1.39673	0.927451	9.97597
7758.45	1500	1.39674	0.929036	9.97601
7779.97	1505	1.39675	0.930619	9.97605
7801.48	1510	1.39675	0.9322	9.97609
7822.97	1515	1.39676	0.933778	9.97613
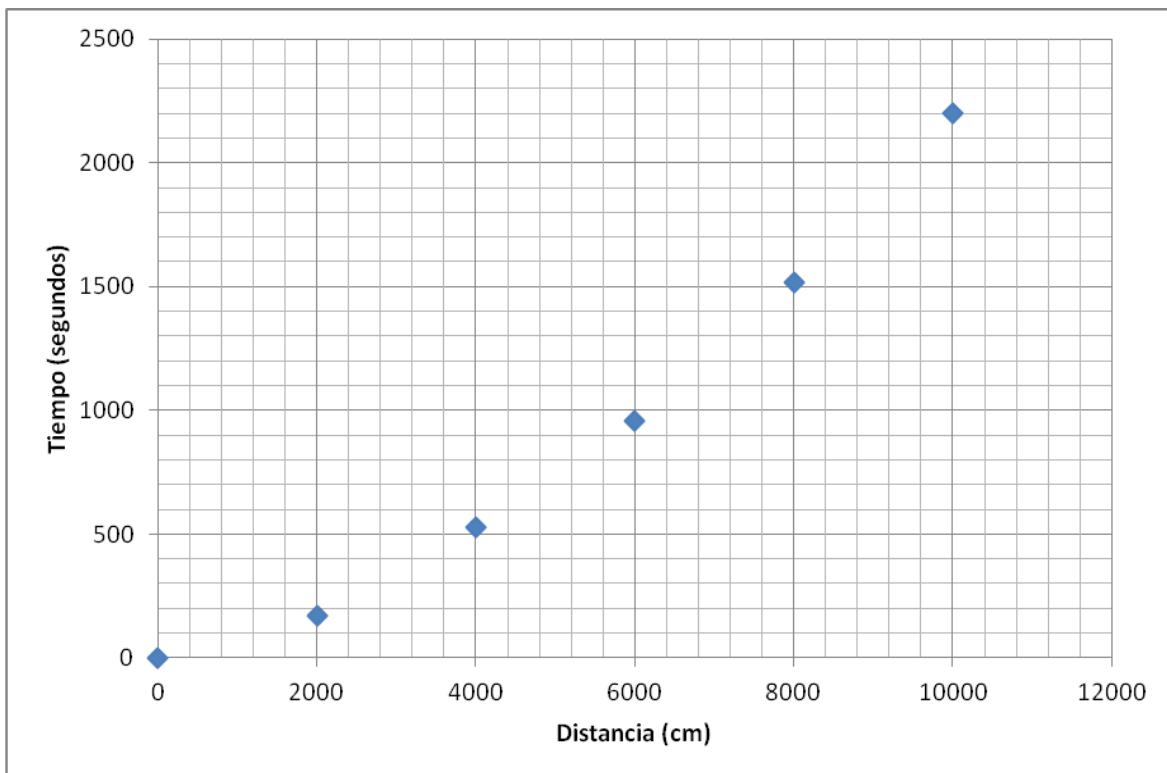
Iteración Levenberg-Marquardt 6				
7844.44	1520	1.39677	0.935354	9.97616
7865.9	1525	1.39678	0.936927	9.9762
7887.34	1530	1.39678	0.938498	9.97624
7908.77	1535	1.39679	0.940066	9.97628
7930.18	1540	1.3968	0.941632	9.97631
7951.57	1545	1.39681	0.943196	9.97635
7972.95	1550	1.39681	0.944757	9.97639
7994.31	1555	1.39682	0.946316	9.97642
8015.65	1560	1.39683	0.947872	9.97646
8036.98	1565	1.39683	0.949427	9.97649
8058.29	1570	1.39684	0.950978	9.97653
8079.59	1575	1.39685	0.952528	9.97657
8100.86	1580	1.39686	0.954075	9.9766
8122.13	1585	1.39686	0.95562	9.97664
8143.38	1590	1.39687	0.957162	9.97667
8164.61	1595	1.39688	0.958702	9.97671
8185.82	1600	1.39688	0.96024	9.97674
8207.02	1605	1.39689	0.961776	9.97678
8228.21	1610	1.3969	0.963309	9.97681
8249.38	1615	1.3969	0.964841	9.97684
8270.53	1620	1.39691	0.96637	9.97688
8291.67	1625	1.39692	0.967896	9.97691
8312.79	1630	1.39692	0.969421	9.97695
8333.89	1635	1.39693	0.970943	9.97698
8354.98	1640	1.39694	0.972463	9.97701
8376.06	1645	1.39694	0.973981	9.97705
8397.12	1650	1.39695	0.975497	9.97708
8418.16	1655	1.39696	0.97701	9.97711
8439.19	1660	1.39696	0.978522	9.97715
8460.2	1665	1.39697	0.980031	9.97718
8481.2	1670	1.39698	0.981538	9.97721
8502.18	1675	1.39698	0.983043	9.97724
8523.15	1680	1.39699	0.984546	9.97728
8544.1	1685	1.39699	0.986047	9.97731
8565.04	1690	1.397	0.987546	9.97734
8585.96	1695	1.39701	0.989042	9.97737
8606.87	1700	1.39701	0.990537	9.9774

Iteración Levenberg-Marquardt 6				
8627.76	1705	1.39702	0.992029	9.97743
8648.64	1710	1.39703	0.99352	9.97747
8669.5	1715	1.39703	0.995008	9.9775
8690.35	1720	1.39704	0.996494	9.97753
8711.18	1725	1.39704	0.997979	9.97756
8732	1730	1.39705	0.999461	9.97759
8752.8	1735	1.39706	1.00094	9.97762
8773.59	1740	1.39706	1.00242	9.97765
8794.36	1745	1.39707	1.0039	9.97768
8815.12	1750	1.39707	1.00537	9.97771
8835.86	1755	1.39708	1.00684	9.97774
8856.59	1760	1.39709	1.00831	9.97777
8877.3	1765	1.39709	1.00978	9.9778
8898	1770	1.3971	1.01125	9.97783
8918.69	1775	1.3971	1.01271	9.97786
8939.36	1780	1.39711	1.01417	9.97789
8960.01	1785	1.39712	1.01563	9.97792
8980.66	1790	1.39712	1.01709	9.97795
9001.28	1795	1.39713	1.01855	9.97798
9021.9	1800	1.39713	1.02	9.97801
9042.49	1805	1.39714	1.02146	9.97804
9063.08	1810	1.39714	1.02291	9.97807
9083.65	1815	1.39715	1.02436	9.97809
9104.2	1820	1.39716	1.0258	9.97812
9124.74	1825	1.39716	1.02725	9.97815
9145.27	1830	1.39717	1.02869	9.97818
9165.78	1835	1.39717	1.03014	9.97821
9186.28	1840	1.39718	1.03158	9.97824
9206.77	1845	1.39718	1.03301	9.97826
9227.24	1850	1.39719	1.03445	9.97829
9247.69	1855	1.39719	1.03588	9.97832
9268.14	1860	1.3972	1.03732	9.97835
9288.57	1865	1.3972	1.03875	9.97838
9308.98	1870	1.39721	1.04018	9.9784
9329.38	1875	1.39722	1.0416	9.97843
9349.77	1880	1.39722	1.04303	9.97846
9370.14	1885	1.39723	1.04445	9.97848
9390.5	1890	1.39723	1.04587	9.97851
9410.85	1895	1.39724	1.04729	9.97854
9431.18	1900	1.39724	1.04871	9.97856
9451.49	1905	1.39725	1.05013	9.97859
9471.8	1910	1.39725	1.05154	9.97862
9492.09	1915	1.39726	1.05296	9.97864
9512.37	1920	1.39726	1.05437	9.97867
9532.63	1925	1.39727	1.05578	9.9787

Iteración Levenberg-Marquardt 6				
9552.88	1930	1.39727	1.05718	9.97872
9573.12	1935	1.39728	1.05859	9.97875
9593.34	1940	1.39728	1.05999	9.97877
9613.55	1945	1.39729	1.0614	9.9788
9633.74	1950	1.39729	1.0628	9.97883
9653.93	1955	1.3973	1.0642	9.97885
9674.1	1960	1.3973	1.0656	9.97888
9694.25	1965	1.39731	1.06699	9.9789
9714.39	1970	1.39731	1.06839	9.97893
9734.52	1975	1.39732	1.06978	9.97895
9754.64	1980	1.39732	1.07117	9.97898
9774.74	1985	1.39733	1.07256	9.979
9794.83	1990	1.39733	1.07395	9.97903
9814.91	1995	1.39734	1.07533	9.97905
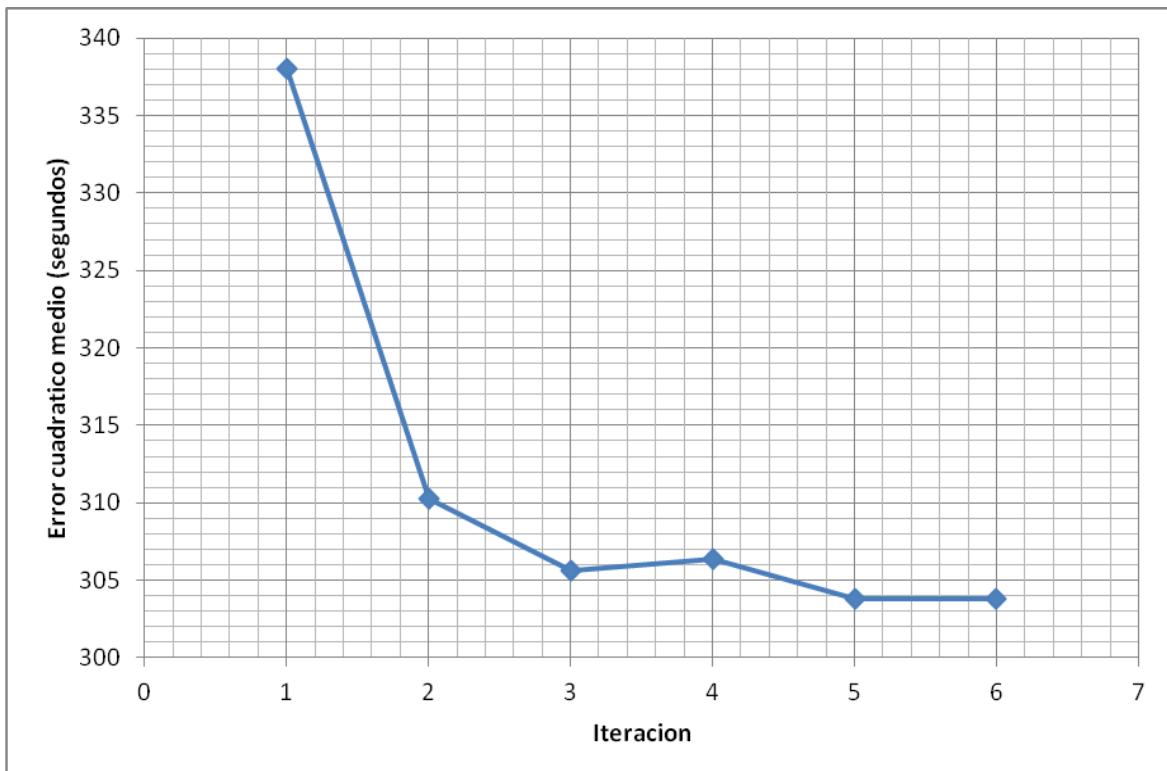
Iteración Levenberg-Marquardt 6				
9834.97	2000	1.39734	1.07672	9.97908
9855.02	2005	1.39735	1.0781	9.9791
9875.06	2010	1.39735	1.07948	9.97913
9895.08	2015	1.39736	1.08086	9.97915
9915.09	2020	1.39736	1.08224	9.97918
9935.09	2025	1.39737	1.08362	9.9792
9955.07	2030	1.39737	1.08499	9.97922
9975.04	2035	1.39738	1.08636	9.97925
9995	2040	1.39738	1.08774	9.97927
10014.9	2045	1.39739	1.08911	9.9793
10034.9	2050	1.39739	1.09047	9.97932

Observados	
0	0
2000	170
4000	530
6000	960
8000	1515
10000	2200
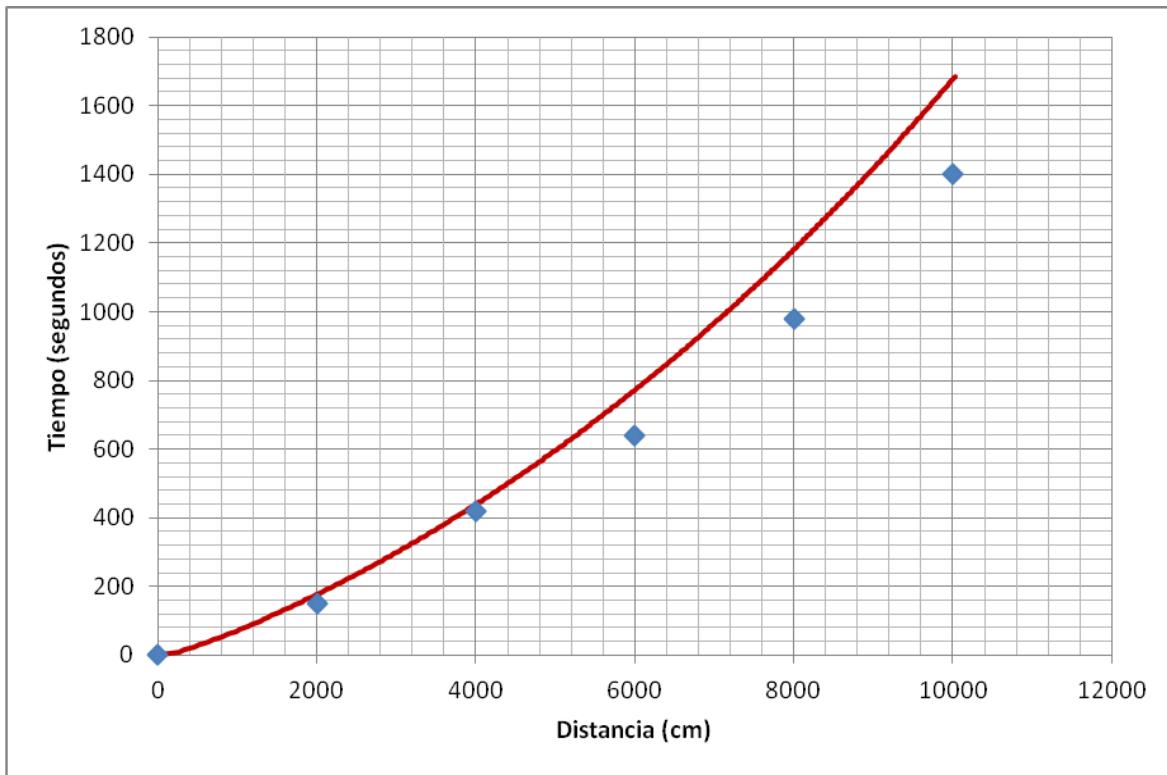
Ilustración 50.- Tiempo y distancia observados para suelo arcilla.

Iteración	ECM
1	338.009
2	310.242
3	305.655
4	306.349
5	303.768
6	303.768

Ilustración 51.- Error cuadrático medio (Arcilla).

Suelo Limo

Ilustración 52.- Iteración 1 de Levenberg-Marquardt para Suelo Limo.

Tabla 7. Primera iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 1					Iteración Levenberg-Marquardt 1					Iteración Levenberg-Marquardt 1				
0	0	0	0	0	1186.47	90	1.91045	0.969183	29.0749	2030.56	180	1.95595	1.3827	29.4205
142.976	5	1.12479	0.209962	142.976	1237.12	95	1.91549	0.996171	29.1128	2074.07	185	1.95708	1.40247	29.4295
259.764	10	1.40256	0.321336	19.6571	1287.21	100	1.92	1.02251	29.1466	2117.29	190	1.95813	1.422	29.438
336.115	15	1.53616	0.395738	24.4729	1336.79	105	1.92405	1.04824	29.177	2160.23	195	1.95913	1.44131	29.4461
392.8	20	1.62292	0.456964	26.0135	1385.87	110	1.9277	1.07341	29.2044	2202.9	200	1.96008	1.46039	29.4538
456.014	25	1.68436	0.510526	26.8752	1434.47	115	1.93101	1.09806	29.2292	2245.29	205	1.96097	1.47925	29.4611
520.109	30	1.73013	0.558867	27.4247	1482.63	120	1.93402	1.12222	29.2517	2287.42	210	1.96182	1.49792	29.4681
581.3	35	1.76535	0.603342	27.8052	1530.35	125	1.93676	1.14593	29.2724	2329.29	215	1.96263	1.51638	29.4747
640.657	40	1.79315	0.644796	28.0831	1577.65	130	1.93926	1.1692	29.2913	2370.91	220	1.9634	1.53466	29.4811
699.304	45	1.81556	0.683802	28.2938	1624.54	135	1.94156	1.19206	29.3088	2412.28	225	1.96413	1.55275	29.4872
756.967	50	1.83395	0.720772	28.4584	1671.05	140	1.94368	1.21455	29.3249	2453.41	230	1.96483	1.57066	29.4931
813.493	55	1.84929	0.756011	28.5901	1717.19	145	1.94563	1.23666	29.3399	2494.29	235	1.9655	1.5884	29.4987
869.056	60	1.86225	0.789755	28.6978	1762.96	150	1.94744	1.25844	29.3538	2534.95	240	1.96615	1.60597	29.5041
923.792	65	1.87331	0.82219	28.7873	1808.38	155	1.94912	1.27988	29.3668	2575.37	245	1.96676	1.62338	29.5093
977.732	70	1.88285	0.853468	28.8629	1853.46	160	1.95068	1.30101	29.3789	2615.57	250	1.96735	1.64063	29.5143
1030.92	75	1.89114	0.883711	28.9275	1898.21	165	1.95213	1.32185	29.3903	2655.55	255	1.96792	1.65773	29.5192
1083.41	80	1.89839	0.913022	28.9834	1942.63	170	1.95349	1.3424	29.401	2695.31	260	1.96846	1.67468	29.5239
1135.24	85	1.90478	0.941488	29.0321	1986.75	175	1.95476	1.36268	29.411	2734.85	265	1.96899	1.69149	29.5284

Iteración Levenberg-Marquardt 1				
2774.19	270	1.9695	1.70816	29.5327
2813.32	275	1.96998	1.7247	29.5369
2852.24	280	1.97046	1.7411	29.541
2890.97	285	1.97091	1.75738	29.545
2929.5	290	1.97135	1.77352	29.5488
2967.83	295	1.97178	1.78955	29.5526
3005.97	300	1.9722	1.80546	29.5562
3043.92	305	1.9726	1.82125	29.5597
3081.69	310	1.97299	1.83693	29.5631
3119.28	315	1.97337	1.8525	29.5664
3156.68	320	1.97373	1.86797	29.5697
3193.91	325	1.97409	1.88332	29.5728
3230.96	330	1.97444	1.89858	29.5759
3267.83	335	1.97478	1.91373	29.5789
3304.54	340	1.97511	1.92879	29.5818
3341.08	345	1.97543	1.94375	29.5847
3377.45	350	1.97574	1.95861	29.5875
3413.66	355	1.97604	1.97339	29.5902
3449.7	360	1.97634	1.98807	29.5928
3485.59	365	1.97663	2.00267	29.5954
3521.32	370	1.97692	2.01718	29.598
3556.89	375	1.97719	2.0316	29.6004
3592.31	380	1.97746	2.04595	29.6029
3627.57	385	1.97773	2.06021	29.6052
3662.69	390	1.97799	2.07439	29.6076
3697.66	395	1.97824	2.08849	29.6098
3732.47	400	1.97849	2.10252	29.6121
3767.15	405	1.97873	2.11647	29.6143
3801.68	410	1.97897	2.13035	29.6164
3836.07	415	1.97921	2.14416	29.6185
3870.32	420	1.97943	2.15789	29.6206
3904.43	425	1.97966	2.17156	29.6226
3938.4	430	1.97988	2.18515	29.6246
3972.24	435	1.98009	2.19868	29.6265
4005.94	440	1.9803	2.21215	29.6284
4039.51	445	1.98051	2.22554	29.6303
4072.95	450	1.98072	2.23888	29.6322
4106.25	455	1.98092	2.25215	29.634
4139.43	460	1.98111	2.26536	29.6358
4172.48	465	1.9813	2.2785	29.6375
4205.41	470	1.98149	2.29159	29.6392
4238.21	475	1.98168	2.30462	29.6409
4270.89	480	1.98186	2.31759	29.6426
4303.44	485	1.98204	2.33051	29.6442
4335.88	490	1.98222	2.34336	29.6458
4368.19	495	1.9824	2.35616	29.6474

Iteración Levenberg-Marquardt 1				
4400.39	500	1.98257	2.36891	29.649
4432.47	505	1.98273	2.38161	29.6505
4464.43	510	1.9829	2.39425	29.652
4496.28	515	1.98306	2.40683	29.6535
4528.01	520	1.98322	2.41937	29.655
4559.63	525	1.98338	2.43186	29.6564
4591.13	530	1.98354	2.44429	29.6578
4622.53	535	1.98369	2.45668	29.6592
4653.82	540	1.98384	2.46902	29.6606
4684.99	545	1.98399	2.48131	29.662
4716.06	550	1.98414	2.49355	29.6633
4747.02	555	1.98428	2.50575	29.6646
4777.88	560	1.98443	2.5179	29.6659
4808.63	565	1.98457	2.53001	29.6672
4839.27	570	1.98471	2.54207	29.6685
4869.82	575	1.98484	2.55408	29.6697
4900.26	580	1.98498	2.56606	29.671
4930.6	585	1.98511	2.57799	29.6722
4960.84	590	1.98524	2.58987	29.6734
4990.97	595	1.98537	2.60172	29.6746
5021.01	600	1.9855	2.61352	29.6757
5050.95	605	1.98562	2.62529	29.6769
5080.8	610	1.98575	2.63701	29.678
5110.55	615	1.98587	2.64869	29.6791
5140.2	620	1.98599	2.66034	29.6802
5169.75	625	1.98611	2.67194	29.6813
5199.22	630	1.98623	2.68351	29.6824
5228.59	635	1.98635	2.69504	29.6835
5257.86	640	1.98646	2.70653	29.6845
5287.05	645	1.98658	2.71798	29.6856
5316.14	650	1.98669	2.7294	29.6866
5345.14	655	1.9868	2.74078	29.6876
5374.06	660	1.98691	2.75213	29.6886
5402.88	665	1.98702	2.76343	29.6896
5431.62	670	1.98712	2.77471	29.6906
5460.27	675	1.98723	2.78595	29.6916
5488.83	680	1.98733	2.79716	29.6925
5517.3	685	1.98744	2.80833	29.6935
5545.69	690	1.98754	2.81947	29.6944
5574	695	1.98764	2.83057	29.6954
5602.22	700	1.98774	2.84164	29.6963
5630.35	705	1.98784	2.85268	29.6972
5658.41	710	1.98794	2.86369	29.6981
5686.38	715	1.98803	2.87467	29.699
5714.27	720	1.98813	2.88561	29.6999
5742.07	725	1.98822	2.89653	29.7007
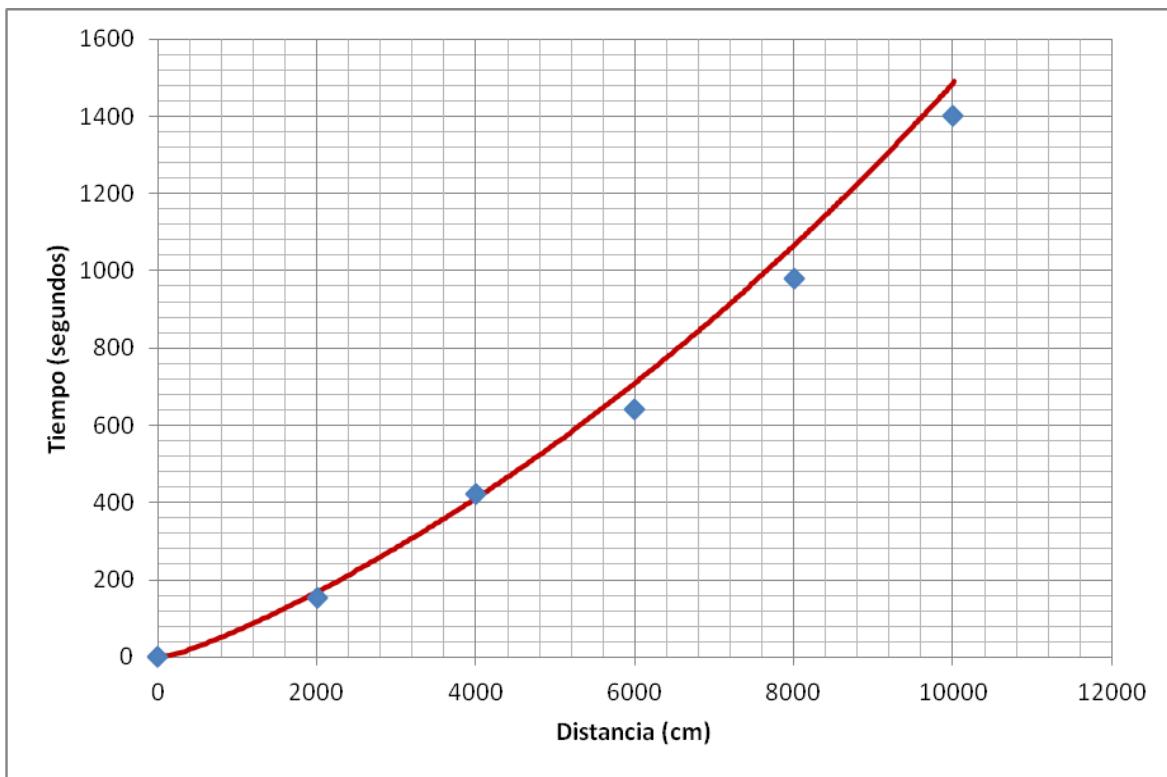
Iteración Levenberg-Marquardt 1				
5769.8	730	1.98832	2.90741	29.7016
5797.45	735	1.98841	2.91826	29.7024
5825.01	740	1.9885	2.92908	29.7033
5852.5	745	1.98859	2.93988	29.7041
5879.91	750	1.98868	2.95064	29.7049
5907.24	755	1.98877	2.96137	29.7057
5934.5	760	1.98886	2.97208	29.7066
5961.68	765	1.98894	2.98276	29.7074
5988.78	770	1.98903	2.9934	29.7081
6015.8	775	1.98912	3.00402	29.7089
6042.75	780	1.9892	3.01462	29.7097
6069.63	785	1.98928	3.02518	29.7105
6096.43	790	1.98937	3.03572	29.7112
6123.16	795	1.98945	3.04623	29.712
6149.81	800	1.98953	3.05671	29.7127
6176.4	805	1.98961	3.06717	29.7135
6202.91	810	1.98969	3.0776	29.7142
6229.35	815	1.98977	3.088	29.7149
6255.71	820	1.98984	3.09838	29.7156
6282.01	825	1.98992	3.10874	29.7164
6308.24	830	1.99	3.11906	29.7171
6334.39	835	1.99007	3.12937	29.7178
6360.48	840	1.99015	3.13964	29.7184
6386.5	845	1.99022	3.1499	29.7191
6412.45	850	1.9903	3.16013	29.7198
6438.33	855	1.99037	3.17033	29.7205
6464.14	860	1.99044	3.18051	29.7211
6489.89	865	1.99051	3.19067	29.7218
6515.57	870	1.99059	3.2008	29.7225
6541.19	875	1.99066	3.21091	29.7231
6566.73	880	1.99073	3.221	29.7238
6592.22	885	1.99079	3.23106	29.7244
6617.63	890	1.99086	3.2411	29.725
6642.99	895	1.99093	3.25112	29.7256
6668.28	900	1.991	3.26112	29.7263
6693.5	905	1.99106	3.27109	29.7269
6718.66	910	1.99113	3.28104	29.7275
6743.76	915	1.9912	3.29097	29.7281
6768.8	920	1.99126	3.30088	29.7287
6793.77	925	1.99133	3.31077	29.7293
6818.68	930	1.99139	3.32064	29.7299
6843.53	935	1.99145	3.33048	29.7305
6868.32	940	1.99152	3.3403	29.7311
6893.05	945	1.99158	3.35011	29.7316
6917.71	950	1.99164	3.35989	29.7322
6942.32	955	1.9917	3.36965	29.7328

Iteración Levenberg-Marquardt 1				
6966.87	960	1.99176	3.37939	29.7333
6991.35	965	1.99182	3.38911	29.7339
7015.78	970	1.99188	3.39881	29.7344
7040.15	975	1.99194	3.40849	29.735
7064.46	980	1.992	3.41816	29.7355
7088.72	985	1.99206	3.4278	29.7361
7112.91	990	1.99212	3.43742	29.7366
7137.05	995	1.99218	3.44702	29.7371
7161.13	1000	1.99223	3.45661	29.7377
7185.16	1005	1.99229	3.46617	29.7382
7209.13	1010	1.99235	3.47572	29.7387
7233.04	1015	1.9924	3.48525	29.7392
7256.89	1020	1.99246	3.49476	29.7397
7280.7	1025	1.99251	3.50425	29.7402
7304.44	1030	1.99257	3.51372	29.7408
7328.13	1035	1.99262	3.52318	29.7413
7351.77	1040	1.99267	3.53261	29.7417
7375.35	1045	1.99273	3.54203	29.7422
7398.88	1050	1.99278	3.55143	29.7427
7422.35	1055	1.99283	3.56081	29.7432
7445.77	1060	1.99289	3.57018	29.7437
7469.14	1065	1.99294	3.57953	29.7442
7492.46	1070	1.99299	3.58886	29.7447
7515.72	1075	1.99304	3.59817	29.7451
7538.93	1080	1.99309	3.60747	29.7456
7562.09	1085	1.99314	3.61675	29.7461
7585.19	1090	1.99319	3.62602	29.7465
7608.25	1095	1.99324	3.63526	29.747
7631.25	1100	1.99329	3.64449	29.7474
7654.2	1105	1.99334	3.65371	29.7479
7677.11	1110	1.99339	3.6629	29.7483
7699.96	1115	1.99344	3.67209	29.7488
7722.76	1120	1.99348	3.68125	29.7492
7745.51	1125	1.99353	3.6904	29.7497
7768.22	1130	1.99358	3.69953	29.7501
7790.87	1135	1.99363	3.70865	29.7505
7813.47	1140	1.99367	3.71775	29.751
7836.03	1145	1.99372	3.72684	29.7514
7858.54	1150	1.99376	3.73591	29.7518
7880.99	1155	1.99381	3.74497	29.7522
7903.41	1160	1.99386	3.75401	29.7527
7925.77	1165	1.9939	3.76303	29.7531
7948.08	1170	1.99395	3.77204	29.7535
7970.35	1175	1.99399	3.78104	29.7539
7992.57	1180	1.99403	3.79002	29.7543
8014.75	1185	1.99408	3.79898	29.7547

Iteración Levenberg-Marquardt 1				
8036.87	1190	1.99412	3.80794	29.7551
8058.95	1195	1.99416	3.81687	29.7555
8080.99	1200	1.99421	3.82579	29.7559
8102.98	1205	1.99425	3.8347	29.7563
8124.92	1210	1.99429	3.84359	29.7567
8146.82	1215	1.99434	3.85247	29.7571
8168.67	1220	1.99438	3.86134	29.7575
8190.48	1225	1.99442	3.87019	29.7579
8212.24	1230	1.99446	3.87903	29.7583
8233.96	1235	1.9945	3.88785	29.7586
8255.63	1240	1.99454	3.89666	29.759
8277.26	1245	1.99458	3.90545	29.7594
8298.84	1250	1.99462	3.91424	29.7598
8320.39	1255	1.99466	3.923	29.7601
8341.88	1260	1.9947	3.93176	29.7605
8363.34	1265	1.99474	3.9405	29.7609
8384.75	1270	1.99478	3.94923	29.7612
8406.12	1275	1.99482	3.95794	29.7616
8427.44	1280	1.99486	3.96665	29.762
8448.72	1285	1.9949	3.97533	29.7623
8469.97	1290	1.99494	3.98401	29.7627
8491.16	1295	1.99498	3.99267	29.763
8512.32	1300	1.99501	4.00132	29.7634
8533.43	1305	1.99505	4.00996	29.7637
8554.51	1310	1.99509	4.01858	29.7641
8575.54	1315	1.99513	4.0272	29.7644
8596.53	1320	1.99516	4.0358	29.7648
8617.48	1325	1.9952	4.04438	29.7651
8638.39	1330	1.99524	4.05296	29.7655
8659.25	1335	1.99527	4.06152	29.7658
8680.08	1340	1.99531	4.07007	29.7661
8700.87	1345	1.99535	4.07861	29.7665
8721.62	1350	1.99538	4.08713	29.7668
8742.32	1355	1.99542	4.09565	29.7671
8762.99	1360	1.99545	4.10415	29.7675
8783.62	1365	1.99549	4.11264	29.7678
8804.21	1370	1.99552	4.12112	29.7681
8824.76	1375	1.99556	4.12958	29.7684
8845.27	1380	1.99559	4.13804	29.7688
8865.74	1385	1.99563	4.14648	29.7691
8886.17	1390	1.99566	4.15491	29.7694
8906.56	1395	1.9957	4.16333	29.7697
8926.92	1400	1.99573	4.17174	29.77
8947.24	1405	1.99576	4.18014	29.7703
8967.52	1410	1.9958	4.18852	29.7707
8987.76	1415	1.99583	4.1969	29.771

Iteración Levenberg-Marquardt 1				
9007.96	1420	1.99586	4.20526	29.7713
9028.13	1425	1.9959	4.21361	29.7716
9048.26	1430	1.99593	4.22195	29.7719
9068.35	1435	1.99596	4.23028	29.7722
9088.4	1440	1.996	4.2386	29.7725
9108.42	1445	1.99603	4.24691	29.7728
9128.4	1450	1.99606	4.2552	29.7731
9148.34	1455	1.99609	4.26349	29.7734
9168.25	1460	1.99612	4.27176	29.7737
9188.12	1465	1.99616	4.28003	29.774
9207.96	1470	1.99619	4.28828	29.7743
9227.76	1475	1.99622	4.29653	29.7745
9247.52	1480	1.99625	4.30476	29.7748
9267.25	1485	1.99628	4.31298	29.7751
9286.94	1490	1.99631	4.32119	29.7754
9306.6	1495	1.99634	4.32939	29.7757
9326.22	1500	1.99637	4.33758	29.776
9345.81	1505	1.9964	4.34576	29.7763
9365.36	1510	1.99643	4.35393	29.7765
9384.88	1515	1.99646	4.3621	29.7768
9404.36	1520	1.99649	4.37025	29.7771
9423.81	1525	1.99652	4.37839	29.7774
9443.22	1530	1.99655	4.38652	29.7776
9462.6	1535	1.99658	4.39464	29.7779
9481.94	1540	1.99661	4.40275	29.7782
9501.25	1545	1.99664	4.41085	29.7785
9520.53	1550	1.99667	4.41894	29.7787
9539.77	1555	1.9967	4.42702	29.779
9558.98	1560	1.99673	4.43509	29.7793
9578.16	1565	1.99675	4.44315	29.7795
9597.3	1570	1.99678	4.4512	29.7798
9616.41	1575	1.99681	4.45924	29.78
9635.49	1580	1.99684	4.46728	29.7803
9654.53	1585	1.99687	4.4753	29.7806
9673.54	1590	1.9969	4.48331	29.7808
9692.52	1595	1.99692	4.49132	29.7811
9711.47	1600	1.99695	4.49931	29.7813
9730.38	1605	1.99698	4.5073	29.7816
9749.26	1610	1.99701	4.51527	29.7818
9768.11	1615	1.99703	4.52324	29.7821
9786.93	1620	1.99706	4.5312	29.7824
9805.71	1625	1.99709	4.53915	29.7826
9824.47	1630	1.99711	4.54708	29.7829
9843.19	1635	1.99714	4.55502	29.7831
9861.88	1640	1.99717	4.56294	29.7833
9880.54	1645	1.99719	4.57085	29.7836

Iteración Levenberg-Marquardt 1				
9899.17	1650	1.99722	4.57875	29.7838
9917.76	1655	1.99725	4.58665	29.7841
9936.33	1660	1.99727	4.59453	29.7843
9954.86	1665	1.9973	4.60241	29.7846
9973.37	1670	1.99732	4.61028	29.7848
9991.84	1675	1.99735	4.61814	29.785
10010.3	1680	1.99738	4.62599	29.7853
10028.7	1685	1.9974	4.63383	29.7855

Ilustración 53.- Iteración 2 de Levenberg-Marquardt para Suelo Limo.

Tabla 8. Segunda iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 2					Iteración Levenberg-Marquardt 2					Iteración Levenberg-Marquardt 2				
0	0	0	0	0	1324.85	100	1.92787	0.913934	29.215	2285.77	200	1.96623	1.30332	29.5057
145.219	5	1.12785	0.188097	145.219	1376.54	105	1.93182	0.93685	29.2442	2330.55	205	1.96706	1.32007	29.5124
264.24	10	1.40583	0.287904	19.7799	1427.75	110	1.93537	0.959262	29.2705	2375.09	210	1.96785	1.33664	29.5189
342.664	15	1.54066	0.35449	24.5622	1478.5	115	1.93858	0.981205	29.2942	2419.37	215	1.9686	1.35303	29.525
400.718	20	1.62853	0.409252	26.0988	1528.82	120	1.94149	1.00271	29.3157	2463.41	220	1.96931	1.36925	29.5309
465.28	25	1.69087	0.457138	26.9595	1578.72	125	1.94413	1.0238	29.3354	2507.21	225	1.96998	1.38531	29.5366
531.008	30	1.73732	0.500342	27.5089	1628.22	130	1.94654	1.04451	29.3534	2550.77	230	1.97063	1.4012	29.542
593.934	35	1.77304	0.540075	27.8892	1677.34	135	1.94874	1.06485	29.3699	2594.11	235	1.97125	1.41694	29.5471
654.996	40	1.80117	0.577099	28.1667	1726.08	140	1.95077	1.08485	29.3852	2637.21	240	1.97184	1.43253	29.5521
715.383	45	1.82379	0.611926	28.3766	1774.46	145	1.95263	1.10452	29.3993	2680.1	245	1.9724	1.44798	29.5569
774.854	50	1.84232	0.644926	28.5401	1822.5	150	1.95435	1.12388	29.4124	2722.77	250	1.97295	1.46328	29.5615
833.229	55	1.85772	0.676373	28.6706	1870.2	155	1.95594	1.14294	29.4245	2765.22	255	1.97347	1.47845	29.566
890.668	60	1.87069	0.706478	28.7769	1917.57	160	1.95741	1.16173	29.4359	2807.46	260	1.97397	1.49348	29.5702
947.311	65	1.88174	0.735409	28.8651	1964.62	165	1.95879	1.18025	29.4466	2849.5	265	1.97445	1.50838	29.5744
1003.19	70	1.89123	0.763301	28.9393	2011.36	170	1.96006	1.19851	29.4565	2891.33	270	1.97491	1.52316	29.5784
1058.34	75	1.89946	0.790264	29.0025	2057.81	175	1.96126	1.21653	29.4659	2932.95	275	1.97536	1.53782	29.5823
1112.83	80	1.90664	0.816391	29.0569	2103.96	180	1.96238	1.23432	29.4748	2974.39	280	1.97579	1.55236	29.586
1166.69	85	1.91295	0.841759	29.1043	2149.82	185	1.96343	1.25188	29.4831	3015.62	285	1.97621	1.56679	29.5896
1219.95	90	1.91851	0.866436	29.1458	2195.41	190	1.96442	1.26923	29.491	3056.67	290	1.97661	1.5811	29.5932
1272.67	95	1.92346	0.890477	29.1824	2240.72	195	1.96535	1.28638	29.4985	3097.52	295	1.977	1.5953	29.5966

Iteración Levenberg-Marquardt 2					Iteración Levenberg-Marquardt 2					Iteración Levenberg-Marquardt 2				
3138.19	300	1.97738	1.6094	29.5999	4842.78	530	1.9877	2.17437	29.6928	6306.77	760	1.99253	2.63963	29.7374
3178.68	305	1.97775	1.62339	29.6031	4876.8	535	1.98784	2.18531	29.6941	6336.56	765	1.99261	2.64903	29.7381
3218.98	310	1.9781	1.63728	29.6062	4910.72	540	1.98798	2.1962	29.6954	6366.26	770	1.99269	2.6584	29.7388
3259.11	315	1.97845	1.65108	29.6093	4944.53	545	1.98811	2.20705	29.6966	6395.89	775	1.99277	2.66775	29.7395
3299.06	320	1.97878	1.66477	29.6122	4978.22	550	1.98825	2.21785	29.6978	6425.44	780	1.99284	2.67707	29.7402
3338.84	325	1.97911	1.67837	29.6151	5011.82	555	1.98838	2.22862	29.699	6454.92	785	1.99292	2.68637	29.7409
3378.44	330	1.97943	1.69188	29.6179	5045.3	560	1.98851	2.23934	29.7002	6484.32	790	1.99299	2.69564	29.7416
3417.88	335	1.97973	1.7053	29.6207	5078.68	565	1.98864	2.25002	29.7014	6513.65	795	1.99307	2.70489	29.7423
3457.15	340	1.98003	1.71863	29.6234	5111.96	570	1.98876	2.26066	29.7026	6542.9	800	1.99314	2.71411	29.743
3496.25	345	1.98033	1.73188	29.626	5145.13	575	1.98889	2.27126	29.7037	6572.08	805	1.99321	2.72331	29.7437
3535.19	350	1.98061	1.74504	29.6285	5178.2	580	1.98901	2.28183	29.7048	6601.18	810	1.99329	2.73249	29.7443
3573.97	355	1.98089	1.75812	29.631	5211.17	585	1.98913	2.29235	29.7059	6630.21	815	1.99336	2.74164	29.745
3612.59	360	1.98116	1.77111	29.6334	5244.03	590	1.98925	2.30284	29.707	6659.17	820	1.99343	2.75077	29.7457
3651.06	365	1.98142	1.78403	29.6358	5276.8	595	1.98936	2.31329	29.7081	6688.06	825	1.9935	2.75988	29.7463
3689.37	370	1.98168	1.79687	29.6381	5309.47	600	1.98948	2.3237	29.7092	6716.87	830	1.99357	2.76897	29.747
3727.52	375	1.98193	1.80964	29.6404	5342.04	605	1.9896	2.33407	29.7102	6745.62	835	1.99364	2.77803	29.7476
3765.53	380	1.98218	1.82233	29.6426	5374.51	610	1.98971	2.34441	29.7113	6774.29	840	1.99371	2.78707	29.7482
3803.38	385	1.98242	1.83495	29.6448	5406.89	615	1.98982	2.35471	29.7123	6802.9	845	1.99377	2.79609	29.7489
3841.09	390	1.98266	1.84749	29.6469	5439.17	620	1.98993	2.36498	29.7133	6831.43	850	1.99384	2.80508	29.7495
3878.65	395	1.98289	1.85997	29.649	5471.35	625	1.99004	2.37521	29.7143	6859.89	855	1.99391	2.81406	29.7501
3916.07	400	1.98311	1.87238	29.651	5503.44	630	1.99015	2.38541	29.7153	6888.29	860	1.99397	2.82301	29.7507
3953.34	405	1.98333	1.88472	29.653	5535.44	635	1.99025	2.39557	29.7163	6916.62	865	1.99404	2.83194	29.7513
3990.47	410	1.98355	1.89699	29.655	5567.34	640	1.99036	2.4057	29.7172	6944.88	870	1.9941	2.84085	29.7519
4027.47	415	1.98376	1.9092	29.6569	5599.15	645	1.99046	2.4158	29.7182	6973.07	875	1.99417	2.84974	29.7525
4064.32	420	1.98397	1.92134	29.6588	5630.87	650	1.99056	2.42586	29.7191	7001.19	880	1.99423	2.85861	29.7531
4101.04	425	1.98417	1.93343	29.6606	5662.49	655	1.99066	2.43589	29.7201	7029.25	885	1.99429	2.86746	29.7537
4137.62	430	1.98437	1.94545	29.6624	5694.03	660	1.99076	2.44589	29.721	7057.24	890	1.99435	2.87629	29.7542
4174.07	435	1.98457	1.95741	29.6642	5725.48	665	1.99086	2.45586	29.7219	7085.16	895	1.99442	2.88509	29.7548
4210.38	440	1.98476	1.96931	29.666	5756.84	670	1.99096	2.46579	29.7228	7113.02	900	1.99448	2.89388	29.7554
4246.56	445	1.98495	1.98115	29.6677	5788.11	675	1.99105	2.4757	29.7237	7140.81	905	1.99454	2.90265	29.7559
4282.62	450	1.98514	1.99293	29.6694	5819.29	680	1.99115	2.48557	29.7246	7168.54	910	1.9946	2.91139	29.7565
4318.54	455	1.98532	2.00466	29.671	5850.38	685	1.99124	2.49542	29.7254	7196.21	915	1.99466	2.92012	29.7571
4354.34	460	1.9855	2.01633	29.6727	5881.39	690	1.99134	2.50523	29.7263	7223.81	920	1.99472	2.92883	29.7576
4390.01	465	1.98567	2.02795	29.6743	5912.32	695	1.99143	2.51501	29.7271	7251.34	925	1.99477	2.93752	29.7582
4425.56	470	1.98584	2.03952	29.6758	5943.15	700	1.99152	2.52477	29.728	7278.82	930	1.99483	2.94619	29.7587
4460.98	475	1.98601	2.05103	29.6774	5973.91	705	1.99161	2.53449	29.7288	7306.23	935	1.99489	2.95484	29.7592
4496.28	480	1.98618	2.06249	29.6789	6004.57	710	1.9917	2.54419	29.7296	7333.57	940	1.99495	2.96347	29.7598
4531.45	485	1.98634	2.07389	29.6804	6035.16	715	1.99178	2.55385	29.7304	7360.86	945	1.995	2.97208	29.7603
4566.51	490	1.9865	2.08525	29.6819	6065.66	720	1.99187	2.56349	29.7312	7388.08	950	1.99506	2.98068	29.7608
4601.45	495	1.98666	2.09656	29.6833	6096.08	725	1.99196	2.57311	29.732	7415.24	955	1.99512	2.98925	29.7613
4636.27	500	1.98682	2.10781	29.6847	6126.42	730	1.99204	2.58269	29.7328	7442.34	960	1.99517	2.99781	29.7618
4670.98	505	1.98697	2.11902	29.6861	6156.68	735	1.99213	2.59225	29.7336	7469.38	965	1.99523	3.00635	29.7623
4705.56	510	1.98712	2.13019	29.6875	6186.86	740	1.99221	2.60177	29.7344	7496.35	970	1.99528	3.01487	29.7629
4740.04	515	1.98727	2.1413	29.6889	6216.96	745	1.99229	2.61128	29.7351	7523.27	975	1.99533	3.02338	29.7634
4774.4	520	1.98742	2.15237	29.6902	6246.97	750	1.99237	2.62075	29.7359	7550.13	980	1.99539	3.03186	29.7639
4808.64	525	1.98756	2.1634	29.6915	6276.91	755	1.99245	2.6302	29.7366	7576.93	985	1.99544	3.04033	29.7643

Iteración Levenberg-Marquardt 2			
7603.67	990	1.99549	3.04878	29.7648
7630.35	995	1.99555	3.05722	29.7653
7656.97	1000	1.9956	3.06564	29.7658
7683.53	1005	1.99565	3.07404	29.7663
7710.03	1010	1.9957	3.08242	29.7668
7736.48	1015	1.99575	3.09078	29.7672
7762.87	1020	1.9958	3.09913	29.7677
7789.2	1025	1.99585	3.10747	29.7682
7815.48	1030	1.9959	3.11578	29.7686
7841.7	1035	1.99595	3.12408	29.7691
7867.86	1040	1.996	3.13237	29.7695
7893.97	1045	1.99605	3.14064	29.77
7920.02	1050	1.9961	3.14889	29.7704
7946.01	1055	1.99614	3.15712	29.7709
7971.95	1060	1.99619	3.16534	29.7713
7997.84	1065	1.99624	3.17355	29.7718
8023.67	1070	1.99629	3.18174	29.7722
8049.45	1075	1.99633	3.18991	29.7726
8075.17	1080	1.99638	3.19807	29.7731
8100.84	1085	1.99642	3.20622	29.7735
8126.46	1090	1.99647	3.21434	29.7739
8152.02	1095	1.99651	3.22246	29.7743
8177.53	1100	1.99656	3.23056	29.7747
8202.99	1105	1.9966	3.23864	29.7752
8228.4	1110	1.99665	3.24671	29.7756
8253.75	1115	1.99669	3.25476	29.776
8279.05	1120	1.99673	3.2628	29.7764
8304.3	1125	1.99678	3.27083	29.7768
8329.5	1130	1.99682	3.27884	29.7772
8354.65	1135	1.99686	3.28684	29.7776
8379.75	1140	1.99691	3.29482	29.778
8404.8	1145	1.99695	3.30279	29.7784
8429.79	1150	1.99699	3.31075	29.7788
8454.74	1155	1.99703	3.31869	29.7791
8479.64	1160	1.99707	3.32662	29.7795
8504.48	1165	1.99711	3.33453	29.7799
8529.28	1170	1.99715	3.34243	29.7803
8554.03	1175	1.99719	3.35032	29.7807
8578.73	1180	1.99723	3.35819	29.781
8603.38	1185	1.99727	3.36606	29.7814
8627.99	1190	1.99731	3.3739	29.7818
8652.54	1195	1.99735	3.38174	29.7821
8677.05	1200	1.99739	3.38956	29.7825
8701.51	1205	1.99743	3.39737	29.7829
8725.92	1210	1.99747	3.40516	29.7832
8750.29	1215	1.99751	3.41295	29.7836

Iteración Levenberg-Marquardt 2			
8774.6	1220	1.99755	3.42072	29.7839
8798.87	1225	1.99758	3.42847	29.7843
8823.1	1230	1.99762	3.43622	29.7846
8847.28	1235	1.99766	3.44395	29.785
8871.41	1240	1.9977	3.45167	29.7853
8895.49	1245	1.99773	3.45938	29.7857
8919.53	1250	1.99777	3.46708	29.786
8943.53	1255	1.99781	3.47476	29.7864
8967.48	1260	1.99784	3.48243	29.7867
8991.38	1265	1.99788	3.49009	29.787
9015.24	1270	1.99791	3.49774	29.7874
9039.06	1275	1.99795	3.50537	29.7877
9062.83	1280	1.99799	3.513	29.788
9086.55	1285	1.99802	3.52061	29.7884
9110.23	1290	1.99806	3.52821	29.7887
9133.87	1295	1.99809	3.5358	29.789
9157.47	1300	1.99813	3.54337	29.7893
9181.02	1305	1.99816	3.55094	29.7897
9204.52	1310	1.99819	3.55849	29.79
9227.99	1315	1.99823	3.56604	29.7903
9251.41	1320	1.99826	3.57357	29.7906
9274.79	1325	1.9983	3.58109	29.7909
9298.12	1330	1.99833	3.5886	29.7912
9321.42	1335	1.99836	3.5961	29.7915
9344.67	1340	1.99839	3.60358	29.7918
9367.88	1345	1.99843	3.61106	29.7922
9391.04	1350	1.99846	3.61852	29.7925
9414.17	1355	1.99849	3.62598	29.7928
9437.25	1360	1.99852	3.63342	29.7931
9460.3	1365	1.99856	3.64086	29.7934
9483.3	1370	1.99859	3.64828	29.7937
9506.26	1375	1.99862	3.65569	29.794
9529.18	1380	1.99865	3.66309	29.7942
9552.06	1385	1.99868	3.67048	29.7945
9574.9	1390	1.99871	3.67786	29.7948
9597.7	1395	1.99875	3.68523	29.7951
9620.45	1400	1.99878	3.69259	29.7954
9643.17	1405	1.99881	3.69994	29.7957
9665.85	1410	1.99884	3.70728	29.796
9688.49	1415	1.99887	3.71461	29.7963
9711.09	1420	1.9989	3.72193	29.7965
9733.65	1425	1.99893	3.72924	29.7968
9756.17	1430	1.99896	3.73654	29.7971
9778.65	1435	1.99899	3.74382	29.7974
9801.1	1440	1.99902	3.7511	29.7977
9823.5	1445	1.99905	3.75837	29.7979

Iteración Levenberg-Marquardt 2			
9845.87	1450	1.99908	3.76563	29.7982
9868.19	1455	1.9991	3.77288	29.7985
9890.48	1460	1.99913	3.78012	29.7987
9912.74	1465	1.99916	3.78735	29.799
9934.95	1470	1.99919	3.79457	29.7993
9957.13	1475	1.99922	3.80178	29.7995
9979.26	1480	1.99925	3.80898	29.7998
10001.4	1485	1.99928	3.81618	29.8001
10023.4	1490	1.9993	3.82336	29.8003

Ilustración 54.- Iteración 3 de Levenberg-Marquardt para Suelo Limo.

Tabla 9. Tercera iteración Levenberg-Marquardt para suelo limo.

Iteración Levenberg-Marquardt 3						Iteración Levenberg-Marquardt 3					Iteración Levenberg-Marquardt 3			
0	0	0	0	0	1224.86	90	1.91968	0.851749	29.1561	2114.79	180	1.9633	1.21315	29.4827
145.541	5	1.1282	0.184964	145.541	1277.88	95	1.92461	0.875371	29.1926	2161	185	1.96434	1.23039	29.4909
264.881	10	1.40625	0.283114	19.7979	1330.37	100	1.92901	0.898418	29.225	2206.94	190	1.96532	1.24743	29.4987
343.61	15	1.54127	0.34858	24.575	1382.37	105	1.93294	0.920932	29.254	2252.61	195	1.96624	1.26427	29.5061
401.868	20	1.62932	0.402418	26.1111	1433.89	110	1.93648	0.942951	29.2801	2298.01	200	1.96711	1.28091	29.5132
466.626	25	1.6918	0.449493	26.9717	1484.97	115	1.93967	0.964509	29.3037	2343.16	205	1.96793	1.29736	29.5199
532.592	30	1.73836	0.491962	27.5211	1535.61	120	1.94257	0.985636	29.325	2388.05	210	1.96871	1.31363	29.5262
595.773	35	1.77415	0.531019	27.9015	1585.83	125	1.94519	1.00636	29.3445	2432.69	215	1.96945	1.32973	29.5323
657.085	40	1.80233	0.56741	28.1789	1635.66	130	1.94759	1.0267	29.3624	2477.09	220	1.97015	1.34566	29.5381
717.727	45	1.82499	0.601641	28.3887	1685.1	135	1.94978	1.04668	29.3788	2521.25	225	1.97082	1.36143	29.5437
777.463	50	1.84353	0.634074	28.552	1734.18	140	1.95179	1.06632	29.3939	2565.18	230	1.97146	1.37703	29.549
836.111	55	1.85894	0.66498	28.6823	1782.9	145	1.95364	1.08565	29.4079	2608.88	235	1.97207	1.39249	29.5542
893.826	60	1.87191	0.694566	28.7885	1831.27	150	1.95534	1.10466	29.4209	2652.36	240	1.97265	1.4078	29.5591
950.749	65	1.88296	0.722998	28.8764	1879.3	155	1.95692	1.12339	29.4329	2695.61	245	1.97321	1.42296	29.5638
1006.91	70	1.89245	0.750407	28.9504	1927.01	160	1.95838	1.14185	29.4442	2738.65	250	1.97375	1.43799	29.5683
1062.36	75	1.90066	0.776902	29.0134	1974.41	165	1.95974	1.16004	29.4547	2781.47	255	1.97426	1.45288	29.5727
1117.13	80	1.90783	0.802575	29.0676	2021.5	170	1.96101	1.17798	29.4646	2824.09	260	1.97476	1.46765	29.577
1171.29	85	1.91412	0.827502	29.1148	2068.29	175	1.96219	1.19568	29.4739	2866.49	265	1.97523	1.48228	29.581

Iteración Levenberg-Marquardt 3				
2908.7	270	1.97569	1.49679	29.585
2950.7	275	1.97613	1.51119	29.5888
2992.51	280	1.97656	1.52546	29.5925
3034.13	285	1.97697	1.53962	29.5961
3075.55	290	1.97737	1.55368	29.5996
3116.78	295	1.97775	1.56762	29.6029
3157.83	300	1.97812	1.58146	29.6062
3198.7	305	1.97848	1.5952	29.6094
3239.39	310	1.97883	1.60884	29.6125
3279.9	315	1.97917	1.62238	29.6155
3320.23	320	1.9795	1.63582	29.6184
3360.39	325	1.97983	1.64917	29.6212
3400.38	330	1.98014	1.66244	29.624
3440.2	335	1.98044	1.67561	29.6267
3479.86	340	1.98074	1.6887	29.6294
3519.35	345	1.98103	1.7017	29.6319
3558.68	350	1.98131	1.71462	29.6344
3597.85	355	1.98158	1.72746	29.6369
3636.86	360	1.98185	1.74022	29.6393
3675.71	365	1.98211	1.7529	29.6416
3714.41	370	1.98236	1.7655	29.6439
3752.96	375	1.98261	1.77803	29.6461
3791.35	380	1.98285	1.79049	29.6483
3829.6	385	1.98309	1.80287	29.6505
3867.7	390	1.98332	1.81519	29.6526
3905.66	395	1.98355	1.82743	29.6546
3943.47	400	1.98377	1.83961	29.6566
3981.13	405	1.98399	1.85173	29.6586
4018.66	410	1.9842	1.86377	29.6605
4056.05	415	1.98441	1.87576	29.6624
4093.29	420	1.98462	1.88768	29.6643
4130.41	425	1.98482	1.89953	29.6661
4167.38	430	1.98502	1.91133	29.6679
4204.23	435	1.98521	1.92307	29.6697
4240.94	440	1.9854	1.93475	29.6714
4277.52	445	1.98558	1.94637	29.6731
4313.97	450	1.98577	1.95794	29.6747
4350.29	455	1.98595	1.96945	29.6764
4386.48	460	1.98612	1.9809	29.678
4422.55	465	1.98629	1.9923	29.6796
4458.5	470	1.98646	2.00365	29.6811
4494.32	475	1.98663	2.01495	29.6826
4530.02	480	1.98679	2.02619	29.6841
4565.59	485	1.98696	2.03739	29.6856
4601.05	490	1.98711	2.04853	29.687
4636.39	495	1.98727	2.05963	29.6885
4671.61	500	1.98742	2.07068	29.6899
4706.71	505	1.98757	2.08168	29.6913
4741.7	510	1.98772	2.09263	29.6926
4776.57	515	1.98787	2.10354	29.694
4811.33	520	1.98801	2.1144	29.6953
4845.98	525	1.98815	2.12522	29.6966
4880.52	530	1.98829	2.13599	29.6979
4914.94	535	1.98843	2.14672	29.6991
4949.26	540	1.98857	2.15741	29.7004
4983.47	545	1.9887	2.16805	29.7016
5017.57	550	1.98883	2.17865	29.7028
5051.56	555	1.98896	2.18922	29.704
5085.45	560	1.98909	2.19974	29.7052
5119.23	565	1.98921	2.21022	29.7063
5152.9	570	1.98934	2.22066	29.7075
5186.48	575	1.98946	2.23106	29.7086
5219.95	580	1.98958	2.24143	29.7097
5253.32	585	1.9897	2.25175	29.7108
5286.59	590	1.98982	2.26204	29.7119
5319.76	595	1.98993	2.27229	29.7129
5352.83	600	1.99005	2.28251	29.714
5385.8	605	1.99016	2.29268	29.715
5418.68	610	1.99027	2.30283	29.7161
5451.45	615	1.99038	2.31293	29.7171
5484.14	620	1.99049	2.32301	29.7181
5516.72	625	1.9906	2.33305	29.7191
5549.21	630	1.9907	2.34305	29.72
5581.61	635	1.99081	2.35302	29.721
5613.92	640	1.99091	2.36296	29.7219
5646.13	645	1.99101	2.37286	29.7229
5678.25	650	1.99111	2.38274	29.7238
5710.28	655	1.99121	2.39258	29.7247
5742.22	660	1.99131	2.40239	29.7256
5774.07	665	1.99141	2.41217	29.7265
5805.83	670	1.9915	2.42191	29.7274
5837.5	675	1.9916	2.43163	29.7283
5869.09	680	1.99169	2.44131	29.7292
5900.58	685	1.99178	2.45097	29.73
5931.99	690	1.99187	2.4606	29.7309
5963.32	695	1.99196	2.47019	29.7317
5994.56	700	1.99205	2.47976	29.7325
6025.71	705	1.99214	2.4893	29.7333
6056.78	710	1.99223	2.49881	29.7342
6087.77	715	1.99232	2.5083	29.735
6118.68	720	1.9924	2.51775	29.7357
6149.5	725	1.99249	2.52718	29.7365
6180.24	730	1.99257	2.53658	29.7373
6210.9	735	1.99265	2.54595	29.7381
6241.48	740	1.99274	2.5553	29.7388
6271.98	745	1.99282	2.56462	29.7396
6302.4	750	1.9929	2.57392	29.7403
6332.74	755	1.99298	2.58319	29.7411
6363	760	1.99305	2.59243	29.7418
6393.18	765	1.99313	2.60165	29.7425
6423.29	770	1.99321	2.61084	29.7432
6453.32	775	1.99328	2.62001	29.7439
6483.27	780	1.99336	2.62915	29.7446
6513.15	785	1.99343	2.63827	29.7453
6542.95	790	1.99351	2.64737	29.746
6572.67	795	1.99358	2.65644	29.7467
6602.33	800	1.99365	2.66549	29.7473
6631.91	805	1.99373	2.67451	29.748
6661.41	810	1.9938	2.68351	29.7487
6690.84	815	1.99387	2.69249	29.7493
6720.2	820	1.99394	2.70144	29.75
6749.49	825	1.99401	2.71038	29.7506
6778.7	830	1.99407	2.71929	29.7512
6807.85	835	1.99414	2.72817	29.7519
6836.92	840	1.99421	2.73704	29.7525
6865.92	845	1.99428	2.74588	29.7531
6894.86	850	1.99434	2.75471	29.7537
6923.72	855	1.99441	2.76351	29.7543
6952.51	860	1.99447	2.77229	29.7549
6981.24	865	1.99454	2.78105	29.7555
7009.9	870	1.9946	2.78979	29.7561
7038.49	875	1.99466	2.7985	29.7567
7067.01	880	1.99473	2.8072	29.7573
7095.46	885	1.99479	2.81588	29.7579
7123.85	890	1.99485	2.82453	29.7584
7152.17	895	1.99491	2.83317	29.759
7180.43	900	1.99497	2.84179	29.7596
7208.62	905	1.99503	2.85038	29.7601
7236.75	910	1.99509	2.85896	29.7607
7264.81	915	1.99515	2.86752	29.7612
7292.8	920	1.99521	2.87606	29.7617
7320.74	925	1.99526	2.88458	29.7623
7348.61	930	1.99532	2.89308	29.7628
7376.41	935	1.99538	2.90156	29.7633
7404.16	940	1.99543	2.91003	29.7639
7431.84	945	1.99549	2.91847	29.7644
7459.45	950	1.99554	2.9269	29.7649
7487.01	955	1.9956	2.93531	29.7654

Iteración Levenberg-Marquardt 3				
7514.5	960	1.99565	2.9437	29.7659
7541.94	965	1.99571	2.95208	29.7664
7569.31	970	1.99576	2.96043	29.7669
7596.62	975	1.99581	2.96877	29.7674
7623.88	980	1.99587	2.97709	29.7679
7651.07	985	1.99592	2.9854	29.7684
7678.2	990	1.99597	2.99368	29.7689
7705.28	995	1.99602	3.00195	29.7694
7732.29	1000	1.99607	3.01021	29.7698
7759.25	1005	1.99613	3.01844	29.7703
7786.14	1010	1.99618	3.02666	29.7708
7812.98	1015	1.99623	3.03486	29.7712
7839.77	1020	1.99628	3.04305	29.7717
7866.49	1025	1.99632	3.05122	29.7722
7893.16	1030	1.99637	3.05938	29.7726
7919.77	1035	1.99642	3.06751	29.7731
7946.33	1040	1.99647	3.07564	29.7735
7972.83	1045	1.99652	3.08374	29.774
7999.27	1050	1.99657	3.09183	29.7744
8025.66	1055	1.99661	3.09991	29.7748
8051.99	1060	1.99666	3.10797	29.7753
8078.27	1065	1.99671	3.11601	29.7757
8104.49	1070	1.99675	3.12404	29.7761
8130.66	1075	1.9968	3.13205	29.7766
8156.77	1080	1.99684	3.14005	29.777
8182.84	1085	1.99689	3.14804	29.7774
8208.84	1090	1.99693	3.15601	29.7778
8234.8	1095	1.99698	3.16396	29.7782
8260.7	1100	1.99702	3.1719	29.7786
8286.54	1105	1.99706	3.17983	29.7791
8312.34	1110	1.99711	3.18774	29.7795
8338.08	1115	1.99715	3.19563	29.7799
8363.77	1120	1.99719	3.20352	29.7803
8389.41	1125	1.99724	3.21138	29.7807
8415	1130	1.99728	3.21924	29.7811
8440.54	1135	1.99732	3.22708	29.7814
8466.02	1140	1.99736	3.23491	29.7818
8491.46	1145	1.9974	3.24272	29.7822
8516.84	1150	1.99745	3.25052	29.7826
8542.18	1155	1.99749	3.2583	29.783
8567.46	1160	1.99753	3.26607	29.7834
8592.7	1165	1.99757	3.27383	29.7837
8617.88	1170	1.99761	3.28158	29.7841
8643.02	1175	1.99765	3.28931	29.7845
8668.1	1180	1.99769	3.29703	29.7849
8693.14	1185	1.99773	3.30474	29.7852

Iteración Levenberg-Marquardt 3				
8718.13	1190	1.99776	3.31243	29.7856
8743.07	1195	1.9978	3.32011	29.7859
8767.97	1200	1.99784	3.32778	29.7863
8792.81	1205	1.99788	3.33543	29.7867
8817.61	1210	1.99792	3.34307	29.787
8842.36	1215	1.99796	3.3507	29.7874
8867.06	1220	1.99799	3.35832	29.7877
8891.72	1225	1.99803	3.36592	29.7881
8916.32	1230	1.99807	3.37351	29.7884
8940.89	1235	1.99811	3.38109	29.7888
8965.4	1240	1.99814	3.38866	29.7891
8989.87	1245	1.99818	3.39622	29.7894
9014.3	1250	1.99821	3.40376	29.7898
9038.67	1255	1.99825	3.41129	29.7901
9063.01	1260	1.99829	3.41881	29.7904
9087.29	1265	1.99832	3.42632	29.7908
9111.53	1270	1.99836	3.43381	29.7911
9135.73	1275	1.99839	3.4413	29.7914
9159.88	1280	1.99843	3.44877	29.7918
9183.99	1285	1.99846	3.45623	29.7921
9208.05	1290	1.9985	3.46368	29.7924
9232.07	1295	1.99853	3.47112	29.7927
9256.05	1300	1.99856	3.47854	29.793
9279.98	1305	1.9986	3.48596	29.7934
9303.87	1310	1.99863	3.49336	29.7937
9327.71	1315	1.99867	3.50076	29.794
9351.51	1320	1.9987	3.50814	29.7943
9375.27	1325	1.99873	3.51551	29.7946
9398.99	1330	1.99876	3.52287	29.7949
9422.66	1335	1.9988	3.53022	29.7952
9446.29	1340	1.99883	3.53756	29.7955
9469.88	1345	1.99886	3.54488	29.7958
9493.42	1350	1.99889	3.5522	29.7961
9516.93	1355	1.99893	3.55951	29.7964
9540.39	1360	1.99896	3.5668	29.7967
9563.81	1365	1.99899	3.57409	29.797
9587.19	1370	1.99902	3.58136	29.7973
9610.53	1375	1.99905	3.58863	29.7976
9633.83	1380	1.99908	3.59588	29.7979
9657.08	1385	1.99911	3.60312	29.7982
9680.3	1390	1.99914	3.61036	29.7985
9703.47	1395	1.99918	3.61758	29.7987
9726.61	1400	1.99921	3.62479	29.799
9749.7	1405	1.99924	3.63199	29.7993
9772.76	1410	1.99927	3.63919	29.7996
9795.77	1415	1.9993	3.64637	29.7999

Iteración Levenberg-Marquardt 3				
9818.75	1420	1.99933	3.65354	29.8001
9841.68	1425	1.99936	3.6607	29.8004
9864.58	1430	1.99938	3.66786	29.8007
9887.44	1435	1.99941	3.675	29.801
9910.25	1440	1.99944	3.68213	29.8012
9933.03	1445	1.99947	3.68926	29.8015
9955.77	1450	1.9995	3.69637	29.8018
9978.47	1455	1.99953	3.70347	29.802
10001.1	1460	1.99956	3.71057	29.8023
10023.8	1465	1.99959	3.71766	29.8026

Ilustración 55.- Iteración 4 de Levenberg-Marquardt para Suelo Limo.

Tabla 10. Cuarta iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 4				
0	0	0	0	0
145.797	5	1.12849	0.182488	145.797
265.39	10	1.40659	0.279326	19.8122
344.362	15	1.54176	0.343909	24.5852
402.781	20	1.62995	0.397016	26.1209
467.695	25	1.69254	0.44345	26.9814
533.851	30	1.73918	0.485339	27.5308
597.233	35	1.77503	0.52386	27.9112
658.745	40	1.80325	0.559752	28.1885
719.59	45	1.82593	0.593511	28.3983
779.537	50	1.84449	0.625497	28.5615
838.4	55	1.85991	0.655976	28.6916
896.335	60	1.87288	0.685152	28.7976
953.481	65	1.88392	0.713189	28.8854
1009.87	70	1.89341	0.740216	28.9592
1065.55	75	1.90162	0.766343	29.0221
1120.56	80	1.90878	0.791658	29.0761
1174.95	85	1.91506	0.816236	29.1231
1228.76	90	1.9206	0.840143	29.1643
1282.02	95	1.92552	0.863434	29.2006

Iteración Levenberg-Marquardt 4				
1334.76	100	1.92991	0.886157	29.2329
1387.01	105	1.93383	0.908355	29.2618
1438.78	110	1.93736	0.930064	29.2877
1490.11	115	1.94054	0.951318	29.3112
1541.01	120	1.94342	0.972146	29.3324
1591.49	125	1.94603	0.992575	29.3518
1641.58	130	1.94842	1.01263	29.3695
1691.28	135	1.9506	1.03233	29.3858
1740.62	140	1.9526	1.05169	29.4008
1789.6	145	1.95443	1.07074	29.4147
1838.24	150	1.95613	1.08949	29.4276
1886.55	155	1.9577	1.10795	29.4396
1934.53	160	1.95915	1.12614	29.4508
1982.2	165	1.9605	1.14407	29.4612
2029.56	170	1.96176	1.16175	29.471
2076.63	175	1.96293	1.1792	29.4802
2123.41	180	1.96403	1.19642	29.4889
2169.9	185	1.96506	1.21342	29.4971
2216.12	190	1.96603	1.23021	29.5048
2262.07	195	1.96695	1.24681	29.5122

Iteración Levenberg-Marquardt 4				
2307.76	200	1.96781	1.26321	29.5191
2353.19	205	1.96862	1.27943	29.5258
2398.37	210	1.9694	1.29546	29.5321
2443.3	215	1.97013	1.31133	29.5381
2487.99	220	1.97082	1.32703	29.5439
2532.44	225	1.97149	1.34256	29.5494
2576.66	230	1.97212	1.35795	29.5546
2620.65	235	1.97272	1.37318	29.5597
2664.42	240	1.9733	1.38827	29.5646
2707.97	245	1.97385	1.40321	29.5692
2751.3	250	1.97438	1.41802	29.5738
2794.42	255	1.97489	1.4327	29.5781
2837.33	260	1.97538	1.44724	29.5823
2880.04	265	1.97585	1.46167	29.5863
2922.54	270	1.9763	1.47597	29.5902
2964.85	275	1.97674	1.49015	29.594
3006.96	280	1.97716	1.50422	29.5977
3048.87	285	1.97757	1.51817	29.6012
3090.6	290	1.97796	1.53202	29.6046
3132.14	295	1.97834	1.54576	29.608

México, 2015

Iteración Levenberg-Marquardt 4				
3173.49	300	1.97871	1.5594	29.6112
3214.66	305	1.97907	1.57294	29.6143
3255.65	310	1.97941	1.58637	29.6174
3296.47	315	1.97975	1.59972	29.6204
3337.11	320	1.98008	1.61296	29.6233
3377.58	325	1.98039	1.62612	29.6261
3417.88	330	1.9807	1.63919	29.6288
3458.01	335	1.981	1.65217	29.6315
3497.97	340	1.98129	1.66506	29.6341
3537.77	345	1.98158	1.67787	29.6366
3577.41	350	1.98186	1.6906	29.6391
3616.89	355	1.98213	1.70325	29.6415
3656.21	360	1.98239	1.71582	29.6439
3695.38	365	1.98265	1.72831	29.6462
3734.39	370	1.9829	1.74073	29.6485
3773.25	375	1.98315	1.75308	29.6507
3811.96	380	1.98339	1.76535	29.6529
3850.52	385	1.98362	1.77755	29.655
3888.93	390	1.98385	1.78969	29.6571
3927.2	395	1.98407	1.80175	29.6591
3965.33	400	1.98429	1.81375	29.6611
4003.31	405	1.98451	1.82568	29.663
4041.15	410	1.98472	1.83755	29.6649
4078.85	415	1.98493	1.84935	29.6668
4116.42	420	1.98513	1.8611	29.6687
4153.85	425	1.98533	1.87278	29.6705
4191.14	430	1.98552	1.8844	29.6722
4228.3	435	1.98571	1.89596	29.674
4265.33	440	1.9859	1.90747	29.6757
4302.23	445	1.98608	1.91892	29.6773
4339	450	1.98626	1.93031	29.679
4375.64	455	1.98644	1.94165	29.6806
4412.15	460	1.98661	1.95293	29.6822
4448.54	465	1.98679	1.96417	29.6837
4484.8	470	1.98695	1.97534	29.6853
4520.94	475	1.98712	1.98647	29.6868
4556.96	480	1.98728	1.99755	29.6883
4592.86	485	1.98744	2.00858	29.6897
4628.63	490	1.9876	2.01955	29.6912
4664.29	495	1.98775	2.03048	29.6926
4699.83	500	1.9879	2.04137	29.694
4735.26	505	1.98805	2.0522	29.6953
4770.56	510	1.9882	2.06299	29.6967
4805.76	515	1.98834	2.07373	29.698
4840.84	520	1.98848	2.08443	29.6993
4875.81	525	1.98862	2.09509	29.7006
4910.67	530	1.98876	2.1057	29.7018
4945.41	535	1.9889	2.11627	29.7031
4980.05	540	1.98903	2.12679	29.7043
5014.58	545	1.98916	2.13727	29.7055
5049	550	1.98929	2.14772	29.7067
5083.32	555	1.98942	2.15812	29.7079
5117.52	560	1.98955	2.16848	29.7091
5151.63	565	1.98967	2.1788	29.7102
5185.63	570	1.98979	2.18909	29.7113
5219.52	575	1.98991	2.19933	29.7124
5253.32	580	1.99003	2.20954	29.7135
5287.01	585	1.99015	2.21971	29.7146
5320.6	590	1.99027	2.22984	29.7157
5354.1	595	1.99038	2.23994	29.7168
5387.49	600	1.99049	2.25	29.7178
5420.78	605	1.99061	2.26002	29.7188
5453.98	610	1.99072	2.27001	29.7198
5487.08	615	1.99082	2.27997	29.7208
5520.09	620	1.99093	2.28989	29.7218
5552.99	625	1.99104	2.29977	29.7228
5585.81	630	1.99114	2.30962	29.7238
5618.53	635	1.99124	2.31944	29.7247
5651.16	640	1.99135	2.32923	29.7257
5683.69	645	1.99145	2.33899	29.7266
5716.14	650	1.99155	2.34871	29.7275
5748.49	655	1.99164	2.3584	29.7284
5780.75	660	1.99174	2.36806	29.7293
5812.92	665	1.99184	2.37769	29.7302
5845.01	670	1.99193	2.38728	29.7311
5877	675	1.99203	2.39685	29.7319
5908.91	680	1.99212	2.40639	29.7328
5940.73	685	1.99221	2.4159	29.7336
5972.46	690	1.9923	2.42538	29.7345
6004.11	695	1.99239	2.43483	29.7353
6035.67	700	1.99248	2.44425	29.7361
6067.15	705	1.99256	2.45364	29.7369
6098.55	710	1.99265	2.46301	29.7377
6129.86	715	1.99274	2.47235	29.7385
6161.08	720	1.99282	2.48166	29.7393
6192.23	725	1.9929	2.49094	29.7401
6223.29	730	1.99299	2.5002	29.7408
6254.27	735	1.99307	2.50943	29.7416
6285.18	740	1.99315	2.51863	29.7424
6316	745	1.99323	2.52781	29.7431
6346.74	750	1.99331	2.53696	29.7438
6377.4	755	1.99339	2.54609	29.7446
6407.99	760	1.99347	2.55519	29.7453
6438.49	765	1.99354	2.56427	29.746
6468.92	770	1.99362	2.57332	29.7467
6499.27	775	1.99369	2.58235	29.7474
6529.55	780	1.99377	2.59135	29.7481
6559.75	785	1.99384	2.60033	29.7488
6589.87	790	1.99391	2.60928	29.7494
6619.92	795	1.99399	2.61821	29.7501
6649.89	800	1.99406	2.62712	29.7508
6679.79	805	1.99413	2.63601	29.7514
6709.62	810	1.9942	2.64487	29.7521
6739.37	815	1.99427	2.65371	29.7527
6769.05	820	1.99434	2.66253	29.7534
6798.66	825	1.99441	2.67132	29.754
6828.2	830	1.99447	2.68009	29.7546
6857.66	835	1.99454	2.68884	29.7553
6887.06	840	1.99461	2.69757	29.7559
6916.38	845	1.99467	2.70628	29.7565
6945.64	850	1.99474	2.71497	29.7571
6974.82	855	1.9948	2.72363	29.7577
7003.94	860	1.99487	2.73227	29.7583
7032.98	865	1.99493	2.7409	29.7589
7061.96	870	1.99499	2.7495	29.7595
7090.87	875	1.99505	2.75808	29.76
7119.71	880	1.99512	2.76665	29.7606
7148.49	885	1.99518	2.77519	29.7612
7177.2	890	1.99524	2.78371	29.7617
7205.84	895	1.9953	2.79221	29.7623
7234.41	900	1.99536	2.8007	29.7629
7262.92	905	1.99542	2.80916	29.7634
7291.37	910	1.99548	2.8176	29.7639
7319.75	915	1.99553	2.82603	29.7645
7348.07	920	1.99559	2.83444	29.765
7376.32	925	1.99565	2.84282	29.7655
7404.51	930	1.9957	2.85119	29.7661
7432.63	935	1.99576	2.85954	29.7666
7460.69	940	1.99582	2.86787	29.7671
7488.69	945	1.99587	2.87619	29.7676
7516.63	950	1.99593	2.88449	29.7681
7544.5	955	1.99598	2.89276	29.7686
7572.32	960	1.99603	2.90102	29.7691
7600.07	965	1.99609	2.90927	29.7696
7627.76	970	1.99614	2.91749	29.7701
7655.39	975	1.99619	2.9257	29.7706
7682.96	980	1.99625	2.93389	29.7711
7710.47	985	1.9963	2.94207	29.7716

Iteración Levenberg-Marquardt 4				
7737.92	990	1.99635	2.95022	29.7721
7765.31	995	1.9964	2.95836	29.7725
7792.64	1000	1.99645	2.96649	29.773
7819.92	1005	1.9965	2.97459	29.7735
7847.13	1010	1.99655	2.98269	29.7739
7874.29	1015	1.9966	2.99076	29.7744
7901.39	1020	1.99665	2.99882	29.7749
7928.43	1025	1.9967	3.00686	29.7753
7955.42	1030	1.99675	3.01489	29.7758
7982.34	1035	1.99679	3.0229	29.7762
8009.21	1040	1.99684	3.03089	29.7767
8036.03	1045	1.99689	3.03887	29.7771
8062.79	1050	1.99693	3.04683	29.7775
8089.49	1055	1.99698	3.05478	29.778
8116.14	1060	1.99703	3.06272	29.7784
8142.73	1065	1.99707	3.07063	29.7788
8169.27	1070	1.99712	3.07854	29.7792
8195.75	1075	1.99716	3.08643	29.7797
8222.18	1080	1.99721	3.0943	29.7801
8248.56	1085	1.99725	3.10216	29.7805
8274.88	1090	1.9973	3.11	29.7809
8301.15	1095	1.99734	3.11783	29.7813
8327.36	1100	1.99738	3.12564	29.7817
8353.53	1105	1.99743	3.13344	29.7821
8379.64	1110	1.99747	3.14123	29.7825
8405.69	1115	1.99751	3.149	29.7829
8431.7	1120	1.99756	3.15676	29.7833
8457.65	1125	1.9976	3.16451	29.7837
8483.55	1130	1.99764	3.17224	29.7841
8509.4	1135	1.99768	3.17995	29.7845
8535.2	1140	1.99772	3.18766	29.7849
8560.95	1145	1.99776	3.19534	29.7853
8586.64	1150	1.9978	3.20302	29.7856
8612.29	1155	1.99784	3.21068	29.786
8637.89	1160	1.99788	3.21833	29.7864
8663.43	1165	1.99792	3.22597	29.7868
8688.93	1170	1.99796	3.23359	29.7871
8714.38	1175	1.998	3.2412	29.7875
8739.78	1180	1.99804	3.2488	29.7879
8765.13	1185	1.99808	3.25638	29.7882
8790.43	1190	1.99812	3.26395	29.7886
8815.68	1195	1.99816	3.27151	29.7889
8840.88	1200	1.9982	3.27906	29.7893
8866.04	1205	1.99823	3.28659	29.7897
8891.15	1210	1.99827	3.29411	29.79
8916.21	1215	1.99831	3.30162	29.7904

Iteración Levenberg-Marquardt 4				
8941.22	1220	1.99835	3.30911	29.7907
8966.18	1225	1.99838	3.3166	29.791
8991.1	1230	1.99842	3.32407	29.7914
9015.98	1235	1.99846	3.33153	29.7917
9040.8	1240	1.99849	3.33897	29.7921
9065.58	1245	1.99853	3.34641	29.7924
9090.31	1250	1.99856	3.35383	29.7927
9115	1255	1.9986	3.36124	29.7931
9139.64	1260	1.99864	3.36864	29.7934
9164.24	1265	1.99867	3.37603	29.7937
9188.79	1270	1.99871	3.38341	29.794
9213.29	1275	1.99874	3.39077	29.7944
9237.75	1280	1.99877	3.39813	29.7947
9262.17	1285	1.99881	3.40547	29.795
9286.54	1290	1.99884	3.4128	29.7953
9310.86	1295	1.99888	3.42012	29.7956
9335.15	1300	1.99891	3.42743	29.796
9359.39	1305	1.99894	3.43473	29.7963
9383.58	1310	1.99898	3.44201	29.7966
9407.73	1315	1.99901	3.44929	29.7969
9431.84	1320	1.99904	3.45655	29.7972
9455.9	1325	1.99908	3.4638	29.7975
9479.93	1330	1.99911	3.47105	29.7978
9503.91	1335	1.99914	3.47828	29.7981
9527.84	1340	1.99917	3.4855	29.7984
9551.74	1345	1.9992	3.49271	29.7987
9575.59	1350	1.99924	3.49991	29.799
9599.4	1355	1.99927	3.5071	29.7993
9623.16	1360	1.9993	3.51428	29.7996
9646.89	1365	1.99933	3.52145	29.7999
9670.57	1370	1.99936	3.5286	29.8002
9694.22	1375	1.99939	3.53575	29.8005
9717.82	1380	1.99942	3.54289	29.8008
9741.38	1385	1.99945	3.55002	29.801
9764.9	1390	1.99948	3.55713	29.8013
9788.38	1395	1.99951	3.56424	29.8016
9811.82	1400	1.99954	3.57134	29.8019
9835.21	1405	1.99957	3.57842	29.8022
9858.57	1410	1.9996	3.5855	29.8024
9881.89	1415	1.99963	3.59257	29.8027
9905.17	1420	1.99966	3.59963	29.803
9928.41	1425	1.99969	3.60667	29.8033
9951.61	1430	1.99972	3.61371	29.8035
9974.77	1435	1.99975	3.62074	29.8038
9997.89	1440	1.99978	3.62776	29.8041
10021	1445	1.99981	3.63477	29.8043

Iteración Levenberg-Marquardt 4				
10044	1450	1.99984	3.64177	29.8046

Ilustración 56.- Iteración 5 de Levenberg-Marquardt para Suelo Limo.

Tabla 11. Quinta iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 5					Iteración Levenberg-Marquardt 5					Iteración Levenberg-Marquardt 5				
0	0	0	0	0	1338.08	100	1.93062	0.87671	29.2398	2315.25	200	1.96836	1.24957	29.5242
145.855	5	1.12832	0.180579	145.855	1390.52	105	1.93453	0.898664	29.2685	2360.9	205	1.96917	1.26561	29.5308
265.628	10	1.40667	0.276405	19.8297	1442.49	110	1.93805	0.920134	29.2944	2406.3	210	1.96993	1.28146	29.5371
344.805	15	1.54206	0.340306	24.5975	1494.01	115	1.94122	0.941154	29.3177	2451.45	215	1.97066	1.29715	29.543
403.369	20	1.63041	0.39285	26.1318	1545.11	120	1.94409	0.961752	29.3388	2496.37	220	1.97135	1.31267	29.5487
468.407	25	1.69311	0.43879	26.9917	1595.79	125	1.9467	0.981955	29.3581	2541.05	225	1.97201	1.32803	29.5542
534.713	30	1.73983	0.480232	27.5408	1646.08	130	1.94907	1.00179	29.3757	2585.49	230	1.97263	1.34324	29.5594
598.258	35	1.77573	0.518342	27.9208	1695.99	135	1.95124	1.02127	29.3919	2629.71	235	1.97323	1.3583	29.5644
659.928	40	1.80399	0.553848	28.1979	1745.54	140	1.95323	1.04042	29.4068	2673.71	240	1.97381	1.37322	29.5693
720.933	45	1.82668	0.587245	28.4074	1794.73	145	1.95506	1.05925	29.4206	2717.49	245	1.97435	1.388	29.5739
781.046	50	1.84525	0.618886	28.5704	1843.57	150	1.95675	1.07779	29.4334	2761.05	250	1.97488	1.40264	29.5784
840.079	55	1.86067	0.649035	28.7003	1892.09	155	1.95831	1.09605	29.4453	2804.4	255	1.97538	1.41715	29.5827
898.185	60	1.87365	0.677896	28.806	1940.28	160	1.95975	1.11404	29.4564	2847.54	260	1.97587	1.43153	29.5868
955.506	65	1.88469	0.705629	28.8936	1988.17	165	1.96109	1.13177	29.4668	2890.48	265	1.97633	1.44579	29.5908
1012.08	70	1.89417	0.732363	28.9672	2035.74	170	1.96235	1.14925	29.4765	2933.22	270	1.97678	1.45993	29.5947
1067.93	75	1.90237	0.758205	29.0298	2083.02	175	1.96351	1.1665	29.4856	2975.76	275	1.97722	1.47395	29.5984
1123.12	80	1.90952	0.783244	29.0837	2130.02	180	1.96461	1.18353	29.4942	3018.1	280	1.97763	1.48786	29.602
1177.7	85	1.9158	0.807555	29.1305	2176.73	185	1.96563	1.20034	29.5024	3060.25	285	1.97804	1.50165	29.6055
1231.7	90	1.92133	0.8312	29.1715	2223.17	190	1.96659	1.21695	29.51	3102.21	290	1.97843	1.51534	29.6089
1285.15	95	1.92624	0.854236	29.2077	2269.34	195	1.9675	1.23336	29.5173	3143.99	295	1.9788	1.52893	29.6122
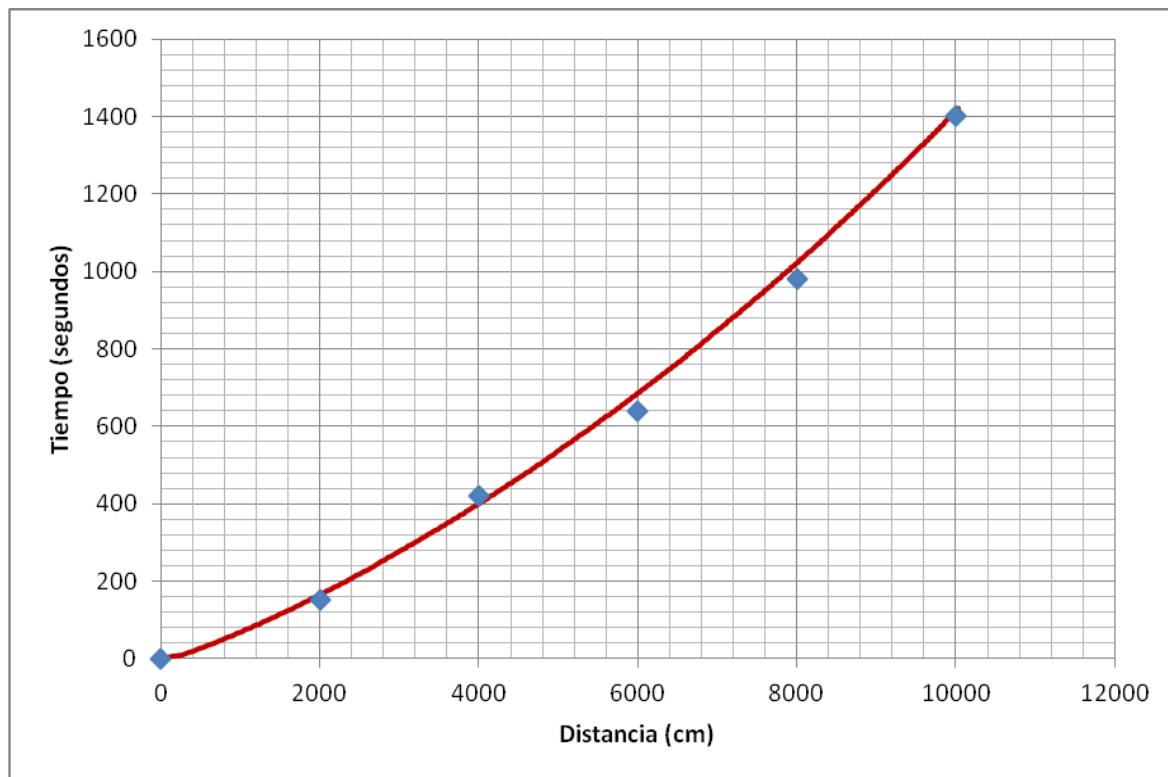
Iteración Levenberg-Marquardt 5				
3185.58	300	1.97917	1.54241	29.6155
3226.98	305	1.97952	1.55579	29.6186
3268.21	310	1.97987	1.56907	29.6216
3309.27	315	1.9802	1.58226	29.6245
3350.15	320	1.98052	1.59536	29.6274
3390.85	325	1.98084	1.60837	29.6302
3431.39	330	1.98114	1.62128	29.6329
3471.76	335	1.98144	1.63411	29.6355
3511.97	340	1.98173	1.64686	29.6381
3552.01	345	1.98201	1.65952	29.6406
3591.89	350	1.98229	1.67211	29.6431
3631.61	355	1.98256	1.68461	29.6455
3671.18	360	1.98282	1.69703	29.6479
3710.59	365	1.98307	1.70938	29.6501
3749.84	370	1.98332	1.72166	29.6524
3788.94	375	1.98356	1.73386	29.6546
3827.9	380	1.9838	1.74599	29.6567
3866.7	385	1.98404	1.75805	29.6588
3905.36	390	1.98426	1.77005	29.6609
3943.87	395	1.98449	1.78197	29.6629
3982.24	400	1.9847	1.79383	29.6649
4020.47	405	1.98492	1.80563	29.6668
4058.56	410	1.98512	1.81736	29.6687
4096.51	415	1.98533	1.82902	29.6705
4134.32	420	1.98553	1.84063	29.6723
4172	425	1.98573	1.85218	29.6741
4209.54	430	1.98592	1.86366	29.6759
4246.94	435	1.98611	1.87509	29.6776
4284.22	440	1.98629	1.88646	29.6793
4321.37	445	1.98648	1.89778	29.6809
4358.38	450	1.98665	1.90904	29.6826
4395.27	455	1.98683	1.92025	29.6842
4432.03	460	1.987	1.9314	29.6857
4468.67	465	1.98717	1.9425	29.6873
4505.18	470	1.98734	1.95355	29.6888
4541.57	475	1.9875	1.96455	29.6903
4577.84	480	1.98766	1.97549	29.6918
4613.98	485	1.98782	1.98639	29.6932
4650.01	490	1.98797	1.99724	29.6946
4685.92	495	1.98813	2.00804	29.696
4721.71	500	1.98828	2.0188	29.6974
4757.38	505	1.98842	2.02951	29.6988
4792.94	510	1.98857	2.04017	29.7001
4828.39	515	1.98871	2.05079	29.7014
4863.72	520	1.98885	2.06136	29.7027
4898.94	525	1.98899	2.07189	29.704

Iteración Levenberg-Marquardt 5				
4934.04	530	1.98913	2.08237	29.7052
4969.04	535	1.98926	2.09282	29.7064
5003.93	540	1.98939	2.10322	29.7077
5038.71	545	1.98953	2.11358	29.7089
5073.38	550	1.98965	2.1239	29.71
5107.95	555	1.98978	2.13418	29.7112
5142.41	560	1.98991	2.14442	29.7124
5176.76	565	1.99003	2.15462	29.7135
5211.01	570	1.99015	2.16478	29.7146
5245.16	575	1.99027	2.17491	29.7157
5279.21	580	1.99039	2.18499	29.7168
5313.15	585	1.9905	2.19504	29.7179
5347	590	1.99062	2.20506	29.7189
5380.74	595	1.99073	2.21503	29.72
5414.38	600	1.99084	2.22497	29.721
5447.93	605	1.99095	2.23488	29.722
5481.38	610	1.99106	2.24475	29.723
5514.73	615	1.99117	2.25459	29.724
5547.99	620	1.99128	2.26439	29.725
5581.15	625	1.99138	2.27416	29.726
5614.22	630	1.99149	2.28389	29.7269
5647.19	635	1.99159	2.2936	29.7279
5680.07	640	1.99169	2.30327	29.7288
5712.86	645	1.99179	2.31291	29.7297
5745.55	650	1.99189	2.32251	29.7306
5778.16	655	1.99198	2.33209	29.7315
5810.67	660	1.99208	2.34163	29.7324
5843.1	665	1.99217	2.35115	29.7333
5875.43	670	1.99227	2.36063	29.7342
5907.68	675	1.99236	2.37009	29.735
5939.84	680	1.99245	2.37951	29.7359
5971.91	685	1.99254	2.3889	29.7367
6003.9	690	1.99263	2.39827	29.7375
6035.8	695	1.99272	2.40761	29.7383
6067.61	700	1.99281	2.41692	29.7392
6099.34	705	1.9929	2.4262	29.74
6130.99	710	1.99298	2.43545	29.7407
6162.55	715	1.99307	2.44468	29.7415
6194.03	720	1.99315	2.45388	29.7423
6225.43	725	1.99323	2.46305	29.7431
6256.74	730	1.99331	2.4722	29.7438
6287.98	735	1.99339	2.48132	29.7446
6319.13	740	1.99347	2.49041	29.7453
6350.21	745	1.99355	2.49948	29.7461
6381.2	750	1.99363	2.50852	29.7468
6412.11	755	1.99371	2.51754	29.7475

Iteración Levenberg-Marquardt 5				
6442.95	760	1.99379	2.52653	29.7482
6473.71	765	1.99386	2.5355	29.7489
6504.39	770	1.99394	2.54444	29.7496
6534.99	775	1.99401	2.55336	29.7503
6565.52	780	1.99409	2.56225	29.751
6595.97	785	1.99416	2.57112	29.7517
6626.34	790	1.99423	2.57997	29.7524
6656.64	795	1.9943	2.5888	29.753
6686.87	800	1.99437	2.5976	29.7537
6717.02	805	1.99444	2.60638	29.7543
6747.1	810	1.99451	2.61513	29.755
6777.1	815	1.99458	2.62386	29.7556
6807.04	820	1.99465	2.63257	29.7562
6836.9	825	1.99472	2.64126	29.7569
6866.68	830	1.99479	2.64993	29.7575
6896.4	835	1.99485	2.65857	29.7581
6926.05	840	1.99492	2.6672	29.7587
6955.62	845	1.99498	2.6758	29.7593
6985.12	850	1.99505	2.68438	29.7599
7014.56	855	1.99511	2.69294	29.7605
7043.93	860	1.99517	2.70148	29.7611
7073.22	865	1.99524	2.71	29.7617
7102.45	870	1.9953	2.7185	29.7623
7131.61	875	1.99536	2.72698	29.7628
7160.7	880	1.99542	2.73544	29.7634
7189.73	885	1.99548	2.74387	29.764
7218.69	890	1.99554	2.75229	29.7645
7247.58	895	1.9956	2.76069	29.7651
7276.41	900	1.99566	2.76907	29.7656
7305.17	905	1.99572	2.77743	29.7662
7333.86	910	1.99578	2.78578	29.7667
7362.49	915	1.99584	2.7941	29.7672
7391.06	920	1.99589	2.8024	29.7678
7419.56	925	1.99595	2.81069	29.7683
7448	930	1.99601	2.81896	29.7688
7476.37	935	1.99606	2.82721	29.7693
7504.68	940	1.99612	2.83544	29.7699
7532.93	945	1.99617	2.84365	29.7704
7561.12	950	1.99622	2.85185	29.7709
7589.24	955	1.99628	2.86002	29.7714
7617.3	960	1.99633	2.86818	29.7719
7645.31	965	1.99638	2.87633	29.7724
7673.25	970	1.99644	2.88445	29.7728
7701.12	975	1.99649	2.89256	29.7733
7728.94	980	1.99654	2.90065	29.7738
7756.7	985	1.99659	2.90872	29.7743

Iteración Levenberg-Marquardt 5				
7784.4	990	1.99664	2.91678	29.7748
7812.04	995	1.99669	2.92482	29.7752
7839.62	1000	1.99674	2.93285	29.7757
7867.14	1005	1.99679	2.94086	29.7762
7894.6	1010	1.99684	2.94885	29.7766
7922.01	1015	1.99689	2.95682	29.7771
7949.36	1020	1.99694	2.96478	29.7775
7976.65	1025	1.99699	2.97273	29.778
8003.88	1030	1.99704	2.98066	29.7784
8031.05	1035	1.99708	2.98857	29.7789
8058.17	1040	1.99713	2.99646	29.7793
8085.23	1045	1.99718	3.00435	29.7797
8112.24	1050	1.99722	3.01221	29.7802
8139.19	1055	1.99727	3.02006	29.7806
8166.09	1060	1.99732	3.0279	29.781
8192.93	1065	1.99736	3.03572	29.7814
8219.71	1070	1.99741	3.04353	29.7819
8246.44	1075	1.99745	3.05132	29.7823
8273.12	1080	1.99749	3.05909	29.7827
8299.74	1085	1.99754	3.06686	29.7831
8326.31	1090	1.99758	3.0746	29.7835
8352.82	1095	1.99763	3.08234	29.7839
8379.28	1100	1.99767	3.09005	29.7843
8405.69	1105	1.99771	3.09776	29.7847
8432.04	1110	1.99775	3.10545	29.7851
8458.35	1115	1.9978	3.11313	29.7855
8484.6	1120	1.99784	3.12079	29.7859
8510.79	1125	1.99788	3.12844	29.7863
8536.94	1130	1.99792	3.13607	29.7867
8563.04	1135	1.99796	3.14369	29.7871
8589.08	1140	1.998	3.1513	29.7874
8615.07	1145	1.99804	3.1589	29.7878
8641.01	1150	1.99808	3.16648	29.7882
8666.9	1155	1.99813	3.17405	29.7886
8692.75	1160	1.99816	3.1816	29.7889
8718.54	1165	1.9982	3.18914	29.7893
8744.28	1170	1.99824	3.19667	29.7897
8769.97	1175	1.99828	3.20419	29.79
8795.61	1180	1.99832	3.21169	29.7904
8821.2	1185	1.99836	3.21918	29.7908
8846.75	1190	1.9984	3.22666	29.7911
8872.24	1195	1.99844	3.23412	29.7915
8897.69	1200	1.99847	3.24157	29.7918
8923.09	1205	1.99851	3.24901	29.7922
8948.44	1210	1.99855	3.25644	29.7925
8973.74	1215	1.99859	3.26386	29.7929

| Iteración Levenberg-Marquardt 5				
8999	1220	1.99862	3.27126	29.7932
9024.21	1225	1.99866	3.27865	29.7935
9049.37	1230	1.99869	3.28603	29.7939
9074.48	1235	1.99873	3.2934	29.7942
9099.55	1240	1.99877	3.30075	29.7946
9124.57	1245	1.9988	3.30809	29.7949
9149.55	1250	1.99884	3.31543	29.7952
9174.48	1255	1.99887	3.32275	29.7955
9199.36	1260	1.99891	3.33005	29.7959
9224.2	1265	1.99894	3.33735	29.7962
9248.99	1270	1.99898	3.34464	29.7965
9273.74	1275	1.99901	3.35191	29.7968
9298.44	1280	1.99905	3.35917	29.7972
9323.09	1285	1.99908	3.36642	29.7975
9347.71	1290	1.99911	3.37366	29.7978
9372.27	1295	1.99915	3.38089	29.7981
9396.8	1300	1.99918	3.38811	29.7984
9421.28	1305	1.99921	3.39531	29.7987
9445.71	1310	1.99925	3.40251	29.799
9470.1	1315	1.99928	3.40969	29.7993
9494.45	1320	1.99931	3.41687	29.7996
9518.76	1325	1.99934	3.42403	29.7999
9543.02	1330	1.99938	3.43118	29.8002
9567.24	1335	1.99941	3.43832	29.8005
9591.41	1340	1.99944	3.44546	29.8008
9615.55	1345	1.99947	3.45258	29.8011
9639.64	1350	1.9995	3.45969	29.8014
9663.69	1355	1.99953	3.46679	29.8017
9687.69	1360	1.99957	3.47387	29.802
9711.66	1365	1.9996	3.48095	29.8023
9735.58	1370	1.99963	3.48802	29.8026
9759.46	1375	1.99966	3.49508	29.8029
9783.3	1380	1.99969	3.50213	29.8032
9807.1	1385	1.99972	3.50917	29.8034
9830.86	1390	1.99975	3.51619	29.8037
9854.58	1395	1.99978	3.52321	29.804
9878.25	1400	1.99981	3.53022	29.8043
9901.89	1405	1.99984	3.53722	29.8046
9925.49	1410	1.99987	3.54421	29.8048
9949.04	1415	1.9999	3.55119	29.8051
9972.56	1420	1.99993	3.55816	29.8054
9996.03	1425	1.99995	3.56512	29.8056
10019.5	1430	1.99998	3.57207	29.8059
10042.9	1435	2.00001	3.57901	29.8062

Ilustración 57.- Iteración 6 de Levenberg-Marquardt para Suelo Limo.

Tabla 12. Sexta iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 6					Iteración Levenberg-Marquardt 6					Iteración Levenberg-Marquardt 6				
0	0	0	0	0	1340.83	100	1.93118	0.869103	29.2447	2321.36	200	1.96879	1.2386	29.5279
146.013	5	1.12847	0.179041	146.013	1393.42	105	1.93508	0.890861	29.2734	2367.19	205	1.9696	1.25448	29.5345
265.942	10	1.40686	0.274053	19.8386	1445.55	110	1.93859	0.912139	29.2991	2412.77	210	1.97036	1.2702	29.5407
345.27	15	1.54235	0.337405	24.6038	1497.23	115	1.94176	0.93297	29.3223	2458.1	215	1.97108	1.28574	29.5466
403.937	20	1.63079	0.389496	26.1379	1548.48	120	1.94462	0.953384	29.3434	2503.2	220	1.97177	1.30112	29.5523
469.072	25	1.69357	0.435038	26.9977	1599.33	125	1.94722	0.973406	29.3626	2548.06	225	1.97242	1.31634	29.5577
535.496	30	1.74034	0.476121	27.5468	1649.78	130	1.94959	0.993059	29.3802	2592.69	230	1.97304	1.33141	29.5629
599.167	35	1.77628	0.513898	27.9269	1699.86	135	1.95175	1.01236	29.3963	2637.1	235	1.97364	1.34633	29.5679
660.962	40	1.80456	0.549095	28.204	1749.57	140	1.95373	1.03134	29.4112	2681.28	240	1.97421	1.36111	29.5727
722.094	45	1.82727	0.582199	28.4134	1798.93	145	1.95556	1.05001	29.4249	2725.24	245	1.97475	1.37575	29.5773
782.339	50	1.84585	0.613563	28.5763	1847.94	150	1.95724	1.06838	29.4376	2768.99	250	1.97527	1.39026	29.5817
841.507	55	1.86128	0.643447	28.7061	1896.63	155	1.95879	1.08647	29.4494	2812.53	255	1.97577	1.40463	29.586
899.751	60	1.87425	0.672054	28.8117	1944.99	160	1.96023	1.10429	29.4605	2855.86	260	1.97625	1.41888	29.5901
957.212	65	1.88529	0.699542	28.8992	1993.05	165	1.96157	1.12186	29.4708	2898.98	265	1.97672	1.43301	29.5941
1013.92	70	1.89477	0.72604	28.9727	2040.8	170	1.96281	1.13919	29.4805	2941.91	270	1.97716	1.44702	29.5979
1069.92	75	1.90296	0.751653	29.0352	2088.25	175	1.96397	1.15628	29.4896	2984.64	275	1.97759	1.46091	29.6016
1125.26	80	1.91011	0.77647	29.089	2135.42	180	1.96506	1.17316	29.4981	3027.17	280	1.97801	1.47469	29.6052
1179.99	85	1.91638	0.800564	29.1357	2182.31	185	1.96608	1.18982	29.5062	3069.51	285	1.97841	1.48836	29.6087
1234.14	90	1.92191	0.823999	29.1766	2228.92	190	1.96704	1.20627	29.5138	3111.66	290	1.9788	1.50192	29.6121
1287.74	95	1.92681	0.84683	29.2127	2275.27	195	1.96794	1.22253	29.5211	3153.63	295	1.97917	1.51538	29.6154
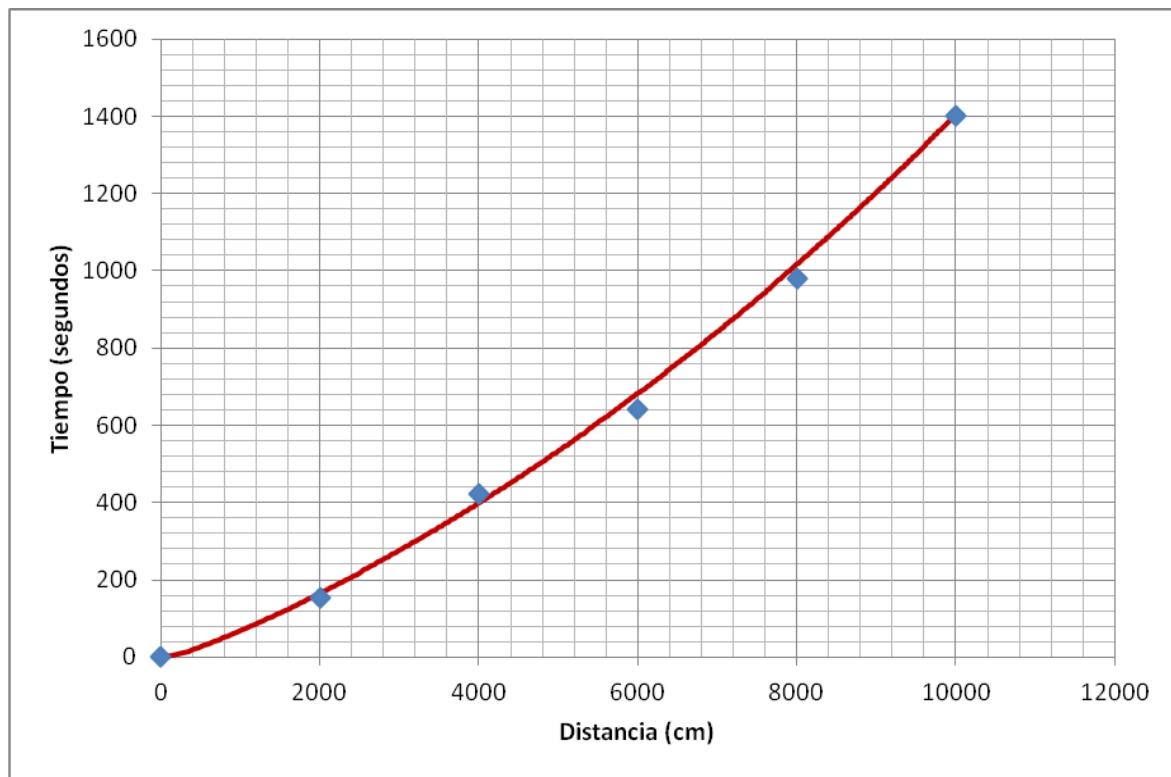
Iteración Levenberg-Marquardt 6			
3195.41	300	1.97953	1.52873	29.6186
3237.01	305	1.97988	1.54199	29.6217
3278.43	310	1.98022	1.55515	29.6247
3319.68	315	1.98056	1.56822	29.6276
3360.75	320	1.98088	1.58119	29.6304
3401.65	325	1.98119	1.59408	29.6332
3442.38	330	1.98149	1.60687	29.6359
3482.95	335	1.98179	1.61958	29.6385
3523.35	340	1.98208	1.63221	29.6411
3563.59	345	1.98236	1.64476	29.6436
3603.66	350	1.98263	1.65722	29.646
3643.58	355	1.98289	1.66961	29.6484
3683.34	360	1.98315	1.68192	29.6507
3722.95	365	1.98341	1.69415	29.653
3762.4	370	1.98365	1.70631	29.6552
3801.7	375	1.9839	1.7184	29.6574
3840.85	380	1.98413	1.73042	29.6595
3879.86	385	1.98436	1.74236	29.6616
3918.71	390	1.98459	1.75424	29.6637
3957.42	395	1.98481	1.76606	29.6657
3995.99	400	1.98503	1.7778	29.6676
4034.42	405	1.98524	1.78949	29.6695
4072.71	410	1.98544	1.80111	29.6714
4110.86	415	1.98565	1.81266	29.6733
4148.87	420	1.98585	1.82416	29.6751
4186.74	425	1.98604	1.8356	29.6768
4224.48	430	1.98623	1.84698	29.6786
4262.09	435	1.98642	1.8583	29.6803
4299.57	440	1.9866	1.86956	29.682
4336.92	445	1.98678	1.88077	29.6836
4374.13	450	1.98696	1.89193	29.6852
4411.22	455	1.98714	1.90303	29.6868
4448.19	460	1.98731	1.91407	29.6884
4485.02	465	1.98747	1.92507	29.6899
4521.74	470	1.98764	1.93601	29.6914
4558.33	475	1.9878	1.9469	29.6929
4594.8	480	1.98796	1.95775	29.6943
4631.15	485	1.98812	1.96854	29.6958
4667.37	490	1.98827	1.97929	29.6972
4703.49	495	1.98842	1.98999	29.6986
4739.48	500	1.98857	2.00064	29.6999
4775.36	505	1.98872	2.01125	29.7013
4811.12	510	1.98886	2.02181	29.7026
4846.77	515	1.989	2.03232	29.7039
4882.3	520	1.98914	2.04279	29.7052
4917.72	525	1.98928	2.05322	29.7064

Iteración Levenberg-Marquardt 6			
4953.04	530	1.98942	2.06361	29.7077
4988.24	535	1.98955	2.07395	29.7089
5023.33	540	1.98968	2.08426	29.7101
5058.31	545	1.98981	2.09452	29.7113
5093.19	550	1.98994	2.10474	29.7125
5127.96	555	1.99007	2.11492	29.7136
5162.62	560	1.99019	2.12506	29.7148
5197.18	565	1.99031	2.13516	29.7159
5231.64	570	1.99043	2.14523	29.717
5265.99	575	1.99055	2.15526	29.7181
5300.24	580	1.99067	2.16525	29.7192
5334.39	585	1.99078	2.1752	29.7203
5368.44	590	1.9909	2.18512	29.7213
5402.38	595	1.99101	2.195	29.7223
5436.23	600	1.99112	2.20484	29.7234
5469.98	605	1.99123	2.21465	29.7244
5503.64	610	1.99134	2.22443	29.7254
5537.2	615	1.99144	2.23417	29.7264
5570.66	620	1.99155	2.24388	29.7273
5604.02	625	1.99165	2.25355	29.7283
5637.29	630	1.99176	2.26319	29.7292
5670.47	635	1.99186	2.2728	29.7302
5703.56	640	1.99196	2.28238	29.7311
5736.55	645	1.99206	2.29193	29.732
5769.45	650	1.99215	2.30144	29.7329
5802.26	655	1.99225	2.31092	29.7338
5834.98	660	1.99235	2.32038	29.7347
5867.61	665	1.99244	2.3298	29.7356
5900.15	670	1.99253	2.33919	29.7364
5932.6	675	1.99263	2.34855	29.7373
5964.97	680	1.99272	2.35788	29.7381
5997.24	685	1.99281	2.36719	29.739
6029.44	690	1.9929	2.37646	29.7398
6061.54	695	1.99298	2.38571	29.7406
6093.56	700	1.99307	2.39493	29.7414
6125.5	705	1.99316	2.40412	29.7422
6157.35	710	1.99324	2.41329	29.743
6189.11	715	1.99333	2.42242	29.7437
6220.8	720	1.99341	2.43153	29.7445
6252.4	725	1.99349	2.44062	29.7453
6283.92	730	1.99357	2.44967	29.746
6315.36	735	1.99365	2.4587	29.7468
6346.72	740	1.99373	2.46771	29.7475
6378	745	1.99381	2.47669	29.7482
6409.2	750	1.99389	2.48564	29.749
6440.31	755	1.99397	2.49457	29.7497

Iteración Levenberg-Marquardt 6			
6471.36	760	1.99404	2.50348	29.7504
6502.32	765	1.99412	2.51236	29.7511
6533.2	770	1.99419	2.52121	29.7518
6564.01	775	1.99427	2.53004	29.7525
6594.74	780	1.99434	2.53885	29.7532
6625.4	785	1.99441	2.54763	29.7538
6655.98	790	1.99448	2.5564	29.7545
6686.48	795	1.99455	2.56513	29.7551
6716.91	800	1.99462	2.57385	29.7558
6747.27	805	1.99469	2.58254	29.7564
6777.55	810	1.99476	2.59121	29.7571
6807.76	815	1.99483	2.59986	29.7577
6837.9	820	1.9949	2.60848	29.7584
6867.96	825	1.99497	2.61709	29.759
6897.95	830	1.99503	2.62567	29.7596
6927.87	835	1.9951	2.63423	29.7602
6957.72	840	1.99516	2.64277	29.7608
6987.5	845	1.99523	2.65128	29.7614
7017.21	850	1.99529	2.65978	29.762
7046.85	855	1.99536	2.66826	29.7626
7076.42	860	1.99542	2.67671	29.7632
7105.92	865	1.99548	2.68515	29.7638
7135.35	870	1.99554	2.69356	29.7643
7164.72	875	1.9956	2.70196	29.7649
7194.02	880	1.99566	2.71033	29.7655
7223.24	885	1.99572	2.71869	29.766
7252.41	890	1.99578	2.72703	29.7666
7281.5	895	1.99584	2.73534	29.7671
7310.53	900	1.9959	2.74364	29.7677
7339.5	905	1.99596	2.75192	29.7682
7368.4	910	1.99602	2.76018	29.7687
7397.23	915	1.99607	2.76842	29.7693
7426	920	1.99613	2.77664	29.7698
7454.7	925	1.99619	2.78484	29.7703
7483.34	930	1.99624	2.79303	29.7708
7511.92	935	1.9963	2.8012	29.7714
7540.44	940	1.99635	2.80935	29.7719
7568.89	945	1.99641	2.81748	29.7724
7597.28	950	1.99646	2.82559	29.7729
7625.6	955	1.99651	2.83369	29.7734
7653.87	960	1.99657	2.84177	29.7739
7682.07	965	1.99662	2.84983	29.7743
7710.21	970	1.99667	2.85788	29.7748
7738.29	975	1.99672	2.8659	29.7753
7766.32	980	1.99677	2.87392	29.7758
7794.28	985	1.99683	2.88191	29.7763

| Iteración Levenberg-Marquardt 6					Iteración Levenberg-Marquardt 6			
7822.18	990	1.99688	2.88989	29.7767	9045.99	1220	1.99884	3.24082	29.7951
7850.02	995	1.99693	2.89785	29.7772	9071.39	1225	1.99888	3.24814	29.7954
7877.8	1000	1.99698	2.90579	29.7777	9096.75	1230	1.99891	3.25544	29.7957
7905.53	1005	1.99702	2.91372	29.7781	9122.06	1235	1.99895	3.26274	29.7961
7933.19	1010	1.99707	2.92163	29.7786	9147.33	1240	1.99898	3.27002	29.7964
7960.8	1015	1.99712	2.92953	29.779	9172.55	1245	1.99902	3.27729	29.7967
7988.35	1020	1.99717	2.93741	29.7795	9197.72	1250	1.99905	3.28454	29.7971
8015.84	1025	1.99722	2.94528	29.7799	9222.84	1255	1.99909	3.29179	29.7974
8043.27	1030	1.99727	2.95313	29.7804	9247.92	1260	1.99912	3.29902	29.7977
8070.65	1035	1.99731	2.96096	29.7808	9272.96	1265	1.99916	3.30625	29.798
8097.97	1040	1.99736	2.96878	29.7812	9297.95	1270	1.99919	3.31346	29.7983
8125.23	1045	1.99741	2.97658	29.7817	9322.89	1275	1.99923	3.32066	29.7987
8152.44	1050	1.99745	2.98437	29.7821	9347.79	1280	1.99926	3.32785	29.799
8179.59	1055	1.9975	2.99214	29.7825	9372.64	1285	1.99929	3.33502	29.7993
8206.69	1060	1.99754	2.9999	29.783	9397.45	1290	1.99933	3.34219	29.7996
8233.73	1065	1.99759	3.00764	29.7834	9422.22	1295	1.99936	3.34935	29.7999
8260.71	1070	1.99763	3.01537	29.7838	9446.94	1300	1.99939	3.35649	29.8002
8287.64	1075	1.99768	3.02308	29.7842	9471.61	1305	1.99943	3.36362	29.8005
8314.52	1080	1.99772	3.03078	29.7846	9496.24	1310	1.99946	3.37075	29.8008
8341.34	1085	1.99777	3.03847	29.785	9520.83	1315	1.99949	3.37786	29.8011
8368.11	1090	1.99781	3.04614	29.7854	9545.37	1320	1.99952	3.38496	29.8014
8394.82	1095	1.99785	3.05379	29.7858	9569.87	1325	1.99956	3.39205	29.8017
8421.49	1100	1.99789	3.06143	29.7862	9594.33	1330	1.99959	3.39913	29.802
8448.09	1105	1.99794	3.06906	29.7866	9618.75	1335	1.99962	3.4062	29.8023
8474.65	1110	1.99798	3.07668	29.787	9643.12	1340	1.99965	3.41326	29.8026
8501.15	1115	1.99802	3.08428	29.7874	9667.45	1345	1.99968	3.42031	29.8029
8527.6	1120	1.99806	3.09186	29.7878	9691.73	1350	1.99971	3.42734	29.8032
8554	1125	1.9981	3.09943	29.7882	9715.98	1355	1.99975	3.43437	29.8035
8580.35	1130	1.99815	3.10699	29.7886	9740.18	1360	1.99978	3.44139	29.8038
8606.64	1135	1.99819	3.11454	29.789	9764.34	1365	1.99981	3.4484	29.8041
8632.88	1140	1.99823	3.12207	29.7893	9788.46	1370	1.99984	3.45539	29.8044
8659.08	1145	1.99827	3.12959	29.7897	9812.53	1375	1.99987	3.46238	29.8047
8685.22	1150	1.99831	3.13709	29.7901	9836.57	1380	1.9999	3.46936	29.8049
8711.31	1155	1.99835	3.14458	29.7904	9860.56	1385	1.99993	3.47632	29.8052
8737.35	1160	1.99839	3.15206	29.7908	9884.51	1390	1.99996	3.48328	29.8055
8763.34	1165	1.99843	3.15953	29.7912	9908.43	1395	1.99999	3.49023	29.8058
8789.28	1170	1.99846	3.16698	29.7915	9932.3	1400	2.00002	3.49716	29.8061
8815.17	1175	1.9985	3.17442	29.7919	9956.13	1405	2.00005	3.50409	29.8063
8841.01	1180	1.99854	3.18185	29.7923	9979.92	1410	2.00008	3.51101	29.8066
8866.8	1185	1.99858	3.18927	29.7926	10003.7	1415	2.0001	3.51792	29.8069
8892.54	1190	1.99862	3.19667	29.793	10027.4	1420	2.00013	3.52481	29.8071
8918.24	1195	1.99866	3.20406	29.7933					
8943.88	1200	1.99869	3.21144	29.7937					
8969.48	1205	1.99873	3.2188	29.794					
8995.03	1210	1.99877	3.22615	29.7944					
9020.53	1215	1.9988	3.23349	29.7947					

Ilustración 58.- Iteración 7 de Levenberg-Marquardt para Suelo Limo.

Tabla 13. Séptima iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 7				
0	0	0	0	0
146.146	5	1.12859	0.177748	146.146
266.206	10	1.40701	0.272076	19.8461
345.663	15	1.5426	0.334967	24.6091
404.416	20	1.63112	0.386676	26.1429
469.632	25	1.69395	0.431885	27.0028
536.155	30	1.74077	0.472664	27.5519
599.933	35	1.77674	0.510163	27.932
661.834	40	1.80504	0.545099	28.209
723.072	45	1.82777	0.577958	28.4184
783.429	50	1.84635	0.609089	28.5812
842.711	55	1.86178	0.63875	28.711
901.071	60	1.87476	0.667143	28.8165
958.649	65	1.8858	0.694426	28.9039
1015.48	70	1.89527	0.720725	28.9773
1071.6	75	1.90346	0.746146	29.0398
1127.07	80	1.91061	0.770776	29.0935
1181.92	85	1.91687	0.794689	29.1401
1236.19	90	1.92239	0.817948	29.1809
1289.92	95	1.92729	0.840606	29.2169

Iteración Levenberg-Marquardt 7				
1343.14	100	1.93165	0.862711	29.2489
1395.87	105	1.93555	0.884303	29.2775
1448.13	110	1.93905	0.90542	29.3031
1499.94	115	1.94221	0.926093	29.3263
1551.33	120	1.94507	0.946352	29.3473
1602.32	125	1.94766	0.966221	29.3664
1652.91	130	1.95002	0.985724	29.3839
1703.12	135	1.95218	1.00488	29.4
1752.97	140	1.95416	1.02371	29.4148
1802.47	145	1.95597	1.04224	29.4285
1851.63	150	1.95765	1.06047	29.4411
1900.45	155	1.9592	1.07842	29.4529
1948.96	160	1.96063	1.09611	29.4639
1997.16	165	1.96196	1.11354	29.4742
2045.06	170	1.9632	1.13074	29.4838
2092.66	175	1.96436	1.1477	29.4929
2139.98	180	1.96544	1.16444	29.5014
2187.01	185	1.96646	1.18097	29.5094
2233.78	190	1.96741	1.1973	29.517
2280.27	195	1.96831	1.21343	29.5242

Iteración Levenberg-Marquardt 7				
2326.51	200	1.96916	1.22938	29.5311
2372.49	205	1.96996	1.24514	29.5376
2418.23	210	1.97071	1.26073	29.5437
2463.72	215	1.97143	1.27615	29.5496
2508.97	220	1.97212	1.29141	29.5553
2553.98	225	1.97277	1.30651	29.5607
2598.77	230	1.97339	1.32147	29.5659
2643.33	235	1.97398	1.33627	29.5708
2687.66	240	1.97454	1.35093	29.5756
2731.78	245	1.97508	1.36546	29.5801
2775.69	250	1.9756	1.37985	29.5846
2819.39	255	1.9761	1.39412	29.5888
2862.87	260	1.97658	1.40826	29.5929
2906.16	265	1.97704	1.42227	29.5968
2949.24	270	1.97748	1.43617	29.6007
2992.13	275	1.97791	1.44995	29.6044
3034.82	280	1.97832	1.46362	29.6079
3077.32	285	1.97872	1.47718	29.6114
3119.64	290	1.97911	1.49064	29.6148
3161.76	295	1.97948	1.50399	29.618
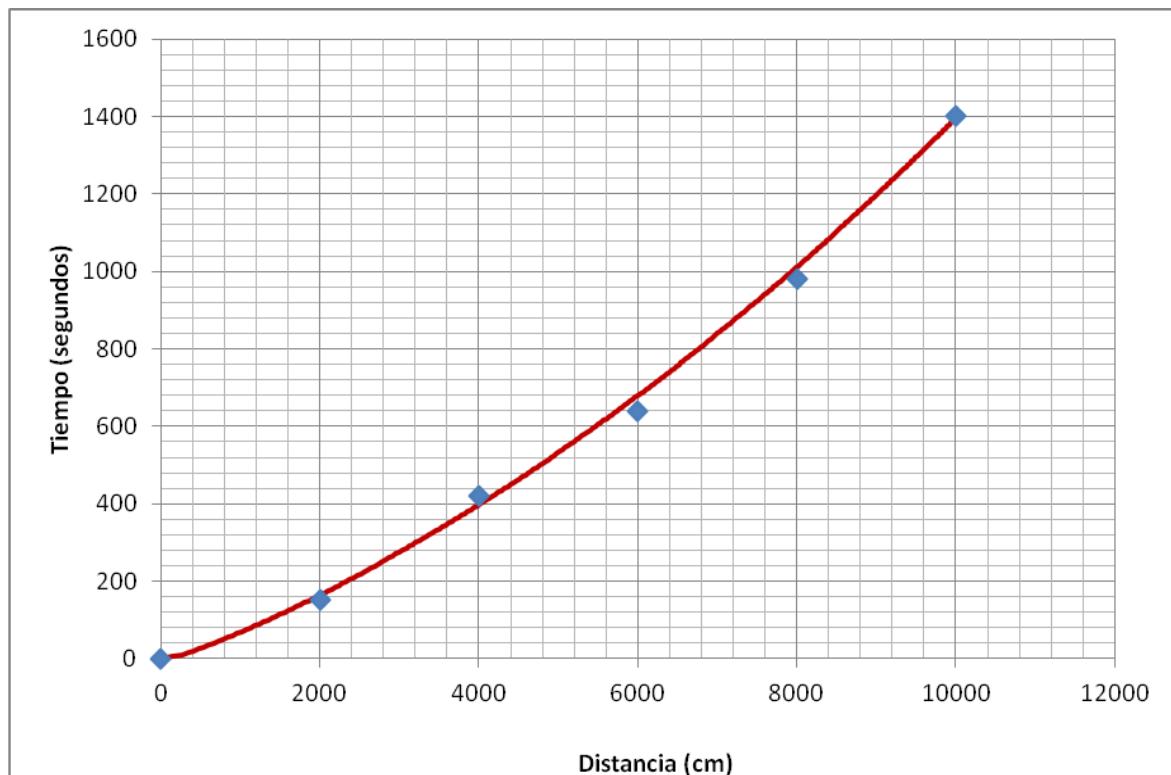
Iteración Levenberg-Marquardt 7					Iteración Levenberg-Marquardt 7					Iteración Levenberg-Marquardt 7			
3203.71	300	1.97984	1.51724	29.6212	4969.08	530	1.98966	2.04785	29.7098	6495.38	760	1.99426	2.48412	29.7522
3245.47	305	1.98019	1.5304	29.6243	5004.46	535	1.98979	2.05811	29.711	6526.52	765	1.99433	2.49292	29.7529
3287.06	310	1.98053	1.54345	29.6272	5039.72	540	1.98992	2.06833	29.7122	6557.58	770	1.9944	2.5017	29.7536
3328.47	315	1.98085	1.55642	29.6301	5074.88	545	1.99005	2.07851	29.7134	6588.56	775	1.99448	2.51046	29.7543
3369.7	320	1.98117	1.56929	29.633	5109.93	550	1.99018	2.08864	29.7145	6619.46	780	1.99455	2.5192	29.755
3410.77	325	1.98148	1.58207	29.6357	5144.87	555	1.9903	2.09874	29.7157	6650.29	785	1.99462	2.52791	29.7556
3451.66	330	1.98179	1.59477	29.6384	5179.71	560	1.99043	2.1088	29.7168	6681.05	790	1.99469	2.5366	29.7563
3492.39	335	1.98208	1.60738	29.641	5214.44	565	1.99055	2.11882	29.7179	6711.72	795	1.99476	2.54526	29.7569
3532.96	340	1.98237	1.61991	29.6436	5249.07	570	1.99067	2.12881	29.719	6742.33	800	1.99483	2.55391	29.7576
3573.36	345	1.98264	1.63235	29.6461	5283.59	575	1.99079	2.13875	29.7201	6772.86	805	1.9949	2.56253	29.7582
3613.6	350	1.98291	1.64472	29.6485	5318.02	580	1.9909	2.14866	29.7212	6803.31	810	1.99497	2.57112	29.7589
3653.69	355	1.98318	1.657	29.6509	5352.34	585	1.99102	2.15853	29.7223	6833.7	815	1.99504	2.5797	29.7595
3693.61	360	1.98344	1.66922	29.6532	5386.56	590	1.99113	2.16837	29.7233	6864.01	820	1.99511	2.58825	29.7601
3733.39	365	1.98369	1.68135	29.6554	5420.68	595	1.99124	2.17817	29.7243	6894.24	825	1.99517	2.59678	29.7607
3773.01	370	1.98393	1.69342	29.6576	5454.7	600	1.99135	2.18793	29.7254	6924.41	830	1.99524	2.60529	29.7614
3812.47	375	1.98417	1.70541	29.6598	5488.63	605	1.99146	2.19766	29.7264	6954.5	835	1.99531	2.61378	29.762
3851.79	380	1.98441	1.71733	29.6619	5522.45	610	1.99157	2.20736	29.7274	6984.52	840	1.99537	2.62225	29.7626
3890.96	385	1.98464	1.72918	29.664	5556.18	615	1.99168	2.21702	29.7283	7014.48	845	1.99543	2.6307	29.7632
3929.99	390	1.98486	1.74097	29.666	5589.82	620	1.99178	2.22665	29.7293	7044.36	850	1.9955	2.63912	29.7638
3968.87	395	1.98508	1.75269	29.668	5623.36	625	1.99188	2.23625	29.7303	7074.17	855	1.99556	2.64753	29.7643
4007.61	400	1.9853	1.76434	29.6699	5656.8	630	1.99199	2.24581	29.7312	7103.91	860	1.99562	2.65592	29.7649
4046.2	405	1.98551	1.77593	29.6718	5690.16	635	1.99209	2.25534	29.7321	7133.59	865	1.99569	2.66428	29.7655
4084.66	410	1.98571	1.78746	29.6737	5723.41	640	1.99219	2.26484	29.733	7163.19	870	1.99575	2.67263	29.7661
4122.97	415	1.98592	1.79892	29.6755	5756.58	645	1.99228	2.27431	29.734	7192.73	875	1.99581	2.68095	29.7666
4161.15	420	1.98611	1.81033	29.6773	5789.65	650	1.99238	2.28374	29.7348	7222.2	880	1.99587	2.68926	29.7672
4199.2	425	1.98631	1.82167	29.6791	5822.64	655	1.99248	2.29315	29.7357	7251.6	885	1.99593	2.69754	29.7678
4237.11	430	1.9865	1.83296	29.6808	5855.53	660	1.99257	2.30252	29.7366	7280.94	890	1.99599	2.70581	29.7683
4274.89	435	1.98668	1.84419	29.6825	5888.33	665	1.99266	2.31187	29.7375	7310.21	895	1.99605	2.71405	29.7688
4312.53	440	1.98687	1.85537	29.6842	5921.05	670	1.99276	2.32118	29.7383	7339.41	900	1.9961	2.72228	29.7694
4350.05	445	1.98705	1.86648	29.6858	5953.67	675	1.99285	2.33047	29.7392	7368.54	905	1.99616	2.73049	29.7699
4387.44	450	1.98722	1.87755	29.6874	5986.21	680	1.99294	2.33972	29.74	7397.62	910	1.99622	2.73868	29.7705
4424.7	455	1.98739	1.88856	29.689	6018.66	685	1.99303	2.34895	29.7408	7426.62	915	1.99628	2.74686	29.771
4461.83	460	1.98756	1.89952	29.6906	6051.03	690	1.99312	2.35815	29.7417	7455.56	920	1.99633	2.75501	29.7715
4498.84	465	1.98773	1.91042	29.6921	6083.31	695	1.9932	2.36732	29.7425	7484.44	925	1.99639	2.76314	29.772
4535.73	470	1.98789	1.92128	29.6936	6115.5	700	1.99329	2.37647	29.7433	7513.25	930	1.99644	2.77126	29.7725
4572.49	475	1.98806	1.93208	29.6951	6147.61	705	1.99338	2.38558	29.7441	7542	935	1.9965	2.77936	29.7731
4609.13	480	1.98821	1.94284	29.6965	6179.63	710	1.99346	2.39467	29.7448	7570.69	940	1.99655	2.78744	29.7736
4645.65	485	1.98837	1.95355	29.6979	6211.58	715	1.99354	2.40373	29.7456	7599.31	945	1.99661	2.79551	29.7741
4682.05	490	1.98852	1.96421	29.6993	6243.43	720	1.99363	2.41277	29.7464	7627.87	950	1.99666	2.80355	29.7746
4718.33	495	1.98867	1.97482	29.7007	6275.21	725	1.99371	2.42177	29.7471	7656.37	955	1.99671	2.81158	29.7751
4754.5	500	1.98882	1.98539	29.7021	6306.9	730	1.99379	2.43076	29.7479	7684.81	960	1.99676	2.81959	29.7755
4790.54	505	1.98897	1.99591	29.7034	6338.52	735	1.99387	2.43971	29.7486	7713.19	965	1.99682	2.82759	29.776
4826.48	510	1.98911	2.00638	29.7047	6370.05	740	1.99395	2.44864	29.7494	7741.5	970	1.99687	2.83556	29.7765
4862.3	515	1.98925	2.01681	29.706	6401.5	745	1.99403	2.45755	29.7501	7769.75	975	1.99692	2.84352	29.777
4898.01	520	1.98939	2.0272	29.7073	6432.87	750	1.9941	2.46643	29.7508	7797.95	980	1.99697	2.85147	29.7775
4933.6	525	1.98953	2.03755	29.7085	6464.17	755	1.99418	2.47528	29.7515	7826.08	985	1.99702	2.85939	29.7779

Iteración Levenberg-Marquardt 7			
7854.15	990	1.99707	2.86731	29.7784
7882.16	995	1.99712	2.8752	29.7789
7910.12	1000	1.99717	2.88308	29.7793
7938.01	1005	1.99722	2.89094	29.7798
7965.85	1010	1.99727	2.89879	29.7802
7993.63	1015	1.99732	2.90662	29.7807
8021.35	1020	1.99736	2.91443	29.7811
8049.01	1025	1.99741	2.92223	29.7816
8076.61	1030	1.99746	2.93001	29.782
8104.16	1035	1.99751	2.93778	29.7824
8131.65	1040	1.99755	2.94553	29.7829
8159.09	1045	1.9976	2.95327	29.7833
8186.47	1050	1.99764	2.96099	29.7837
8213.79	1055	1.99769	2.9687	29.7842
8241.05	1060	1.99773	2.97639	29.7846
8268.27	1065	1.99778	2.98407	29.785
8295.42	1070	1.99782	2.99173	29.7854
8322.52	1075	1.99787	2.99938	29.7858
8349.57	1080	1.99791	3.00701	29.7862
8376.56	1085	1.99795	3.01463	29.7866
8403.5	1090	1.998	3.02224	29.787
8430.39	1095	1.99804	3.02983	29.7874
8457.22	1100	1.99808	3.03741	29.7878
8483.99	1105	1.99813	3.04497	29.7882
8510.72	1110	1.99817	3.05252	29.7886
8537.39	1115	1.99821	3.06005	29.789
8564.01	1120	1.99825	3.06757	29.7894
8590.58	1125	1.99829	3.07508	29.7898
8617.09	1130	1.99833	3.08258	29.7902
8643.56	1135	1.99837	3.09006	29.7905
8669.97	1140	1.99841	3.09753	29.7909
8696.33	1145	1.99845	3.10498	29.7913
8722.64	1150	1.99849	3.11242	29.7917
8748.9	1155	1.99853	3.11985	29.792
8775.11	1160	1.99857	3.12727	29.7924
8801.27	1165	1.99861	3.13467	29.7928
8827.38	1170	1.99865	3.14206	29.7931
8853.44	1175	1.99869	3.14944	29.7935
8879.45	1180	1.99873	3.1568	29.7938
8905.41	1185	1.99876	3.16415	29.7942
8931.32	1190	1.9988	3.17149	29.7945
8957.18	1195	1.99884	3.17882	29.7949
8983	1200	1.99888	3.18613	29.7952
9008.76	1205	1.99891	3.19343	29.7956
9034.48	1210	1.99895	3.20072	29.7959
9060.15	1215	1.99899	3.208	29.7963

Iteración Levenberg-Marquardt 7			
9085.77	1220	1.99902	3.21527	29.7966
9111.35	1225	1.99906	3.22252	29.7969
9136.87	1230	1.99909	3.22976	29.7973
9162.35	1235	1.99913	3.237	29.7976
9187.79	1240	1.99917	3.24421	29.7979
9213.17	1245	1.9992	3.25142	29.7983
9238.51	1250	1.99924	3.25862	29.7986
9263.81	1255	1.99927	3.2658	29.7989
9289.05	1260	1.9993	3.27297	29.7992
9314.26	1265	1.99934	3.28013	29.7996
9339.41	1270	1.99937	3.28728	29.7999
9364.52	1275	1.99941	3.29442	29.8002
9389.59	1280	1.99944	3.30155	29.8005
9414.61	1285	1.99947	3.30867	29.8008
9439.58	1290	1.99951	3.31577	29.8011
9464.51	1295	1.99954	3.32286	29.8014
9489.4	1300	1.99957	3.32995	29.8018
9514.24	1305	1.99961	3.33702	29.8021
9539.04	1310	1.99964	3.34408	29.8024
9563.8	1315	1.99967	3.35113	29.8027
9588.51	1320	1.9997	3.35817	29.803
9613.17	1325	1.99973	3.3652	29.8033
9637.8	1330	1.99977	3.37222	29.8036
9662.38	1335	1.9998	3.37923	29.8039
9686.91	1340	1.99983	3.38623	29.8041
9711.41	1345	1.99986	3.39322	29.8044
9735.86	1350	1.99989	3.40019	29.8047
9760.27	1355	1.99992	3.40716	29.805
9784.64	1360	1.99995	3.41412	29.8053
9808.96	1365	1.99998	3.42106	29.8056
9833.25	1370	2.00001	3.428	29.8059
9857.49	1375	2.00004	3.43493	29.8062
9881.69	1380	2.00007	3.44184	29.8064
9905.85	1385	2.0001	3.44875	29.8067
9929.97	1390	2.00013	3.45565	29.807
9954.04	1395	2.00016	3.46254	29.8073
9978.08	1400	2.00019	3.46941	29.8075
10002.1	1405	2.00022	3.47628	29.8078
10026	1410	2.00025	3.48314	29.8081

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Ilustración 59.- Iteración 8 de Levenberg-Marquardt para Suelo Limo.

Tabla 14. Octava iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 8					Iteración Levenberg-Marquardt 8					Iteración Levenberg-Marquardt 8				
0	0	0	0	0	1344.93	100	1.93201	0.857786	29.2521	2330.49	200	1.96944	1.22227	29.5335
146.249	5	1.12868	0.176752	146.249	1397.75	105	1.93591	0.879252	29.2806	2376.59	205	1.97023	1.23794	29.5399
266.41	10	1.40713	0.270553	19.8519	1450.12	110	1.93941	0.900245	29.3062	2422.45	210	1.97099	1.25344	29.5461
345.966	15	1.54279	0.333088	24.6132	1502.04	115	1.94256	0.920796	29.3293	2468.05	215	1.97171	1.26877	29.552
404.785	20	1.63136	0.384504	26.1468	1553.53	120	1.94541	0.940935	29.3503	2513.42	220	1.97239	1.28393	29.5576
470.065	25	1.69425	0.429455	27.0067	1604.62	125	1.948	0.960686	29.3694	2558.56	225	1.97303	1.29895	29.563
536.664	30	1.7411	0.470002	27.5558	1655.32	130	1.95036	0.980074	29.3868	2603.46	230	1.97365	1.31381	29.5681
600.525	35	1.7771	0.507286	27.9359	1705.64	135	1.95251	0.999119	29.4028	2648.14	235	1.97424	1.32852	29.5731
662.506	40	1.80541	0.542021	28.2129	1755.6	140	1.95448	1.01784	29.4176	2692.6	240	1.9748	1.3431	29.5778
723.828	45	1.82815	0.574691	28.4223	1805.2	145	1.9563	1.03625	29.4312	2736.84	245	1.97534	1.35754	29.5824
784.27	50	1.84674	0.605642	28.5851	1854.47	150	1.95797	1.05437	29.4439	2780.87	250	1.97586	1.37184	29.5867
843.641	55	1.86217	0.635132	28.7147	1903.41	155	1.95951	1.07222	29.4556	2824.69	255	1.97635	1.38602	29.591
902.09	60	1.87515	0.66336	28.8202	1952.03	160	1.96094	1.0898	29.4666	2868.3	260	1.97683	1.40007	29.595
959.759	65	1.88619	0.690484	28.9076	2000.34	165	1.96227	1.10713	29.4768	2911.7	265	1.97729	1.414	29.599
1016.68	70	1.89566	0.716631	28.9809	2048.35	170	1.9635	1.12422	29.4864	2954.91	270	1.97773	1.42782	29.6028
1072.9	75	1.90385	0.741904	29.0433	2096.07	175	1.96466	1.14108	29.4954	2997.92	275	1.97815	1.44152	29.6065
1128.46	80	1.91099	0.766391	29.0969	2143.5	180	1.96574	1.15773	29.5039	3040.74	280	1.97857	1.4551	29.61
1183.41	85	1.91725	0.790164	29.1435	2190.65	185	1.96675	1.17416	29.5119	3083.37	285	1.97896	1.46858	29.6135
1237.78	90	1.92276	0.813286	29.1842	2237.53	190	1.9677	1.19039	29.5195	3125.8	290	1.97934	1.48196	29.6168
1291.61	95	1.92766	0.835811	29.2202	2284.14	195	1.96859	1.20642	29.5267	3168.06	295	1.97971	1.49523	29.6201
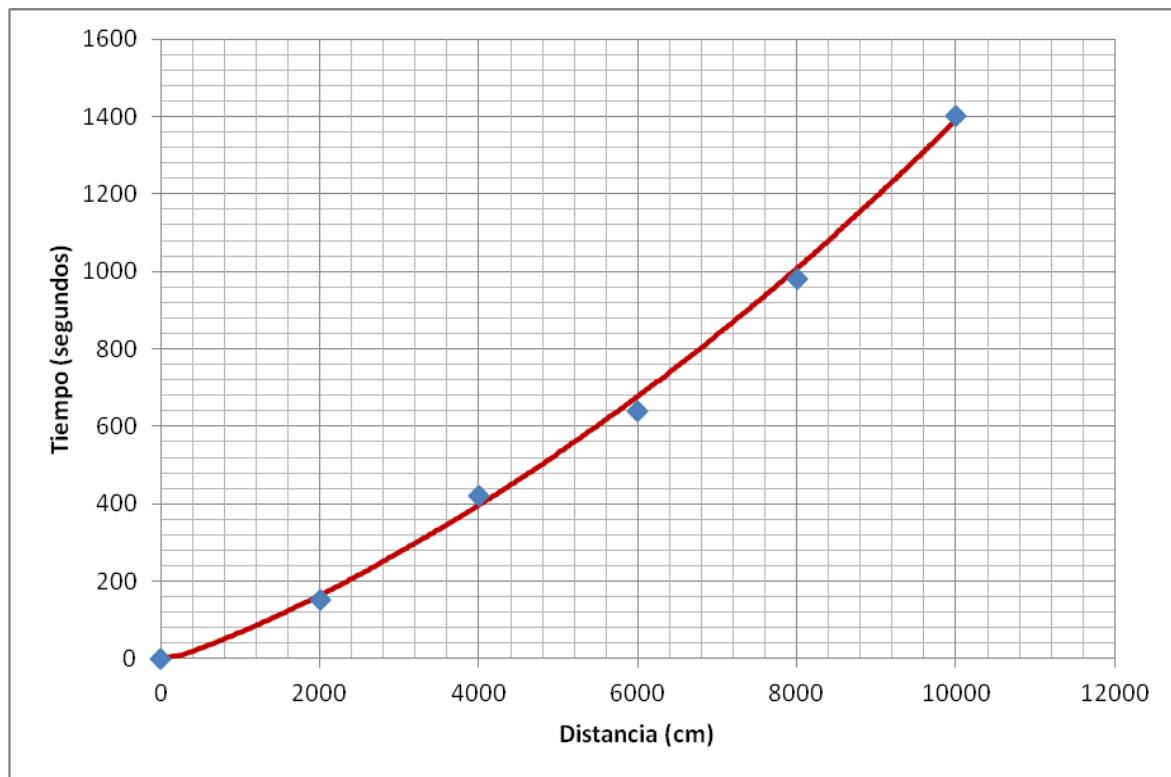
Iteración Levenberg-Marquardt 8				
3210.12	300	1.98007	1.5084	29.6232
3252.01	305	1.98042	1.52147	29.6263
3293.72	310	1.98076	1.53445	29.6292
3335.26	315	1.98109	1.54733	29.6321
3376.62	320	1.9814	1.56012	29.6349
3417.82	325	1.98171	1.57283	29.6377
3458.84	330	1.98201	1.58545	29.6403
3499.7	335	1.9823	1.59798	29.6429
3540.39	340	1.98259	1.61043	29.6455
3580.92	345	1.98287	1.6228	29.648
3621.29	350	1.98314	1.63509	29.6504
3661.5	355	1.9834	1.6473	29.6527
3701.56	360	1.98366	1.65944	29.655
3741.46	365	1.98391	1.6715	29.6573
3781.21	370	1.98415	1.68349	29.6595
3820.81	375	1.98439	1.69541	29.6616
3860.25	380	1.98462	1.70725	29.6637
3899.55	385	1.98485	1.71903	29.6658
3938.71	390	1.98507	1.73075	29.6678
3977.72	395	1.98529	1.74239	29.6698
4016.59	400	1.98551	1.75397	29.6717
4055.31	405	1.98572	1.76549	29.6736
4093.9	410	1.98592	1.77695	29.6755
4132.35	415	1.98612	1.78834	29.6773
4170.66	420	1.98632	1.79968	29.6791
4208.83	425	1.98651	1.81095	29.6808
4246.88	430	1.9867	1.82217	29.6826
4284.79	435	1.98688	1.83333	29.6843
4322.56	440	1.98707	1.84443	29.6859
4360.21	445	1.98725	1.85548	29.6875
4397.73	450	1.98742	1.86648	29.6891
4435.12	455	1.98759	1.87742	29.6907
4472.39	460	1.98776	1.88831	29.6923
4509.53	465	1.98793	1.89915	29.6938
4546.55	470	1.98809	1.90994	29.6953
4583.44	475	1.98825	1.92067	29.6967
4620.22	480	1.98841	1.93136	29.6982
4656.87	485	1.98856	1.942	29.6996
4693.4	490	1.98872	1.9526	29.701
4729.82	495	1.98886	1.96314	29.7023
4766.11	500	1.98901	1.97364	29.7037
4802.3	505	1.98916	1.9841	29.705
4838.36	510	1.9893	1.99451	29.7063
4874.32	515	1.98944	2.00487	29.7076
4910.16	520	1.98958	2.0152	29.7089
4945.89	525	1.98971	2.02548	29.7101

Iteración Levenberg-Marquardt 8				
4981.5	530	1.98985	2.03571	29.7114
5017.01	535	1.98998	2.04591	29.7126
5052.41	540	1.99011	2.05606	29.7138
5087.7	545	1.99024	2.06618	29.715
5122.88	550	1.99036	2.07625	29.7161
5157.96	555	1.99049	2.08629	29.7173
5192.93	560	1.99061	2.09628	29.7184
5227.79	565	1.99073	2.10624	29.7195
5262.56	570	1.99085	2.11616	29.7206
5297.22	575	1.99097	2.12604	29.7217
5331.77	580	1.99108	2.13589	29.7228
5366.23	585	1.9912	2.1457	29.7238
5400.58	590	1.99131	2.15547	29.7248
5434.84	595	1.99142	2.16521	29.7259
5469	600	1.99153	2.17492	29.7269
5503.06	605	1.99164	2.18458	29.7279
5537.02	610	1.99175	2.19422	29.7289
5570.88	615	1.99185	2.20382	29.7298
5604.65	620	1.99196	2.21339	29.7308
5638.33	625	1.99206	2.22292	29.7318
5671.91	630	1.99216	2.23242	29.7327
5705.39	635	1.99226	2.24189	29.7336
5738.78	640	1.99236	2.25133	29.7345
5772.08	645	1.99246	2.26074	29.7354
5805.29	650	1.99255	2.27012	29.7363
5838.41	655	1.99265	2.27946	29.7372
5871.44	660	1.99274	2.28878	29.7381
5904.38	665	1.99284	2.29806	29.739
5937.23	670	1.99293	2.30732	29.7398
5969.99	675	1.99302	2.31654	29.7406
6002.66	680	1.99311	2.32574	29.7415
6035.25	685	1.9932	2.33491	29.7423
6067.75	690	1.99329	2.34405	29.7431
6100.16	695	1.99337	2.35316	29.7439
6132.49	700	1.99346	2.36225	29.7447
6164.73	705	1.99354	2.37131	29.7455
6196.89	710	1.99363	2.38034	29.7463
6228.97	715	1.99371	2.38934	29.747
6260.96	720	1.99379	2.39832	29.7478
6292.87	725	1.99387	2.40727	29.7486
6324.7	730	1.99396	2.41619	29.7493
6356.45	735	1.99403	2.42509	29.75
6388.11	740	1.99411	2.43397	29.7508
6419.7	745	1.99419	2.44281	29.7515
6451.21	750	1.99427	2.45164	29.7522
6482.64	755	1.99434	2.46044	29.7529

Iteración Levenberg-Marquardt 8				
6513.98	760	1.99442	2.46921	29.7536
6545.26	765	1.99449	2.47796	29.7543
6576.45	770	1.99457	2.48669	29.755
6607.57	775	1.99464	2.49539	29.7557
6638.61	780	1.99471	2.50407	29.7563
6669.57	785	1.99479	2.51272	29.757
6700.46	790	1.99486	2.52136	29.7577
6731.27	795	1.99493	2.52997	29.7583
6762.01	800	1.995	2.53855	29.759
6792.67	805	1.99507	2.54712	29.7596
6823.26	810	1.99513	2.55566	29.7602
6853.78	815	1.9952	2.56418	29.7609
6884.22	820	1.99527	2.57268	29.7615
6914.6	825	1.99533	2.58116	29.7621
6944.9	830	1.9954	2.58961	29.7627
6975.12	835	1.99546	2.59804	29.7633
7005.28	840	1.99553	2.60646	29.7639
7035.37	845	1.99559	2.61485	29.7645
7065.38	850	1.99566	2.62322	29.7651
7095.33	855	1.99572	2.63157	29.7657
7125.21	860	1.99578	2.6399	29.7663
7155.01	865	1.99584	2.64822	29.7668
7184.75	870	1.9959	2.65651	29.7674
7214.43	875	1.99596	2.66478	29.768
7244.03	880	1.99602	2.67303	29.7685
7273.57	885	1.99608	2.68126	29.7691
7303.03	890	1.99614	2.68947	29.7696
7332.44	895	1.9962	2.69767	29.7702
7361.77	900	1.99626	2.70584	29.7707
7391.04	905	1.99632	2.714	29.7712
7420.25	910	1.99637	2.72214	29.7718
7449.39	915	1.99643	2.73026	29.7723
7478.47	920	1.99649	2.73836	29.7728
7507.48	925	1.99654	2.74644	29.7733
7536.42	930	1.9966	2.7545	29.7739
7565.31	935	1.99665	2.76255	29.7744
7594.13	940	1.9967	2.77058	29.7749
7622.88	945	1.99676	2.77859	29.7754
7651.58	950	1.99681	2.78658	29.7759
7680.21	955	1.99686	2.79456	29.7763
7708.78	960	1.99692	2.80252	29.7768
7737.29	965	1.99697	2.81046	29.7773
7765.74	970	1.99702	2.81839	29.7778
7794.12	975	1.99707	2.8263	29.7783
7822.45	980	1.99712	2.83419	29.7787
7850.72	985	1.99717	2.84206	29.7792

		Iteración Levenberg-Marquardt 8					Iteración Levenberg-Marquardt 8		
7878.92	990	1.99722	2.84992	29.7797	9116.61	1220	1.99916	3.1956	29.7978
7907.07	995	1.99727	2.85777	29.7801	9142.32	1225	1.9992	3.20281	29.7981
7935.15	1000	1.99732	2.86559	29.7806	9167.97	1230	1.99923	3.21	29.7985
7963.18	1005	1.99737	2.8734	29.7811	9193.58	1235	1.99927	3.21718	29.7988
7991.15	1010	1.99742	2.8812	29.7815	9219.15	1240	1.99931	3.22435	29.7991
8019.06	1015	1.99747	2.88898	29.782	9244.66	1245	1.99934	3.23151	29.7995
8046.92	1020	1.99751	2.89674	29.7824	9270.13	1250	1.99938	3.23866	29.7998
8074.71	1025	1.99756	2.90449	29.7828	9295.56	1255	1.99941	3.2458	29.8001
8102.45	1030	1.99761	2.91222	29.7833	9320.94	1260	1.99944	3.25292	29.8004
8130.13	1035	1.99765	2.91994	29.7837	9346.27	1265	1.99948	3.26004	29.8007
8157.75	1040	1.9977	2.92764	29.7841	9371.55	1270	1.99951	3.26714	29.8011
8185.32	1045	1.99775	2.93532	29.7846	9396.79	1275	1.99955	3.27423	29.8014
8212.83	1050	1.99779	2.943	29.785	9421.99	1280	1.99958	3.28131	29.8017
8240.29	1055	1.99784	2.95065	29.7854	9447.14	1285	1.99961	3.28838	29.802
8267.68	1060	1.99788	2.95829	29.7858	9472.24	1290	1.99965	3.29544	29.8023
8295.03	1065	1.99793	2.96592	29.7862	9497.31	1295	1.99968	3.30248	29.8026
8322.32	1070	1.99797	2.97353	29.7867	9522.32	1300	1.99971	3.30952	29.8029
8349.55	1075	1.99801	2.98113	29.7871	9547.29	1305	1.99974	3.31655	29.8032
8376.73	1080	1.99806	2.98872	29.7875	9572.22	1310	1.99978	3.32356	29.8035
8403.85	1085	1.9981	2.99629	29.7879	9597.1	1315	1.99981	3.33056	29.8038
8430.92	1090	1.99814	3.00384	29.7883	9621.94	1320	1.99984	3.33756	29.8041
8457.94	1095	1.99819	3.01138	29.7887	9646.74	1325	1.99987	3.34454	29.8044
8484.9	1100	1.99823	3.01891	29.7891	9671.49	1330	1.9999	3.35151	29.8047
8511.81	1105	1.99827	3.02642	29.7895	9696.2	1335	1.99994	3.35847	29.805
8538.67	1110	1.99831	3.03392	29.7899	9720.87	1340	1.99997	3.36543	29.8053
8565.48	1115	1.99835	3.04141	29.7902	9745.49	1345	2	3.37237	29.8056
8592.23	1120	1.9984	3.04888	29.7906	9770.07	1350	2.00003	3.3793	29.8059
8618.93	1125	1.99844	3.05634	29.791	9794.61	1355	2.00006	3.38622	29.8062
8645.57	1130	1.99848	3.06378	29.7914	9819.11	1360	2.00009	3.39313	29.8065
8672.17	1135	1.99852	3.07122	29.7918	9843.56	1365	2.00012	3.40003	29.8067
8698.71	1140	1.99856	3.07864	29.7921	9867.97	1370	2.00015	3.40692	29.807
8725.21	1145	1.9986	3.08604	29.7925	9892.34	1375	2.00018	3.4138	29.8073
8751.65	1150	1.99864	3.09343	29.7929	9916.67	1380	2.00021	3.42067	29.8076
8778.04	1155	1.99868	3.10081	29.7932	9940.96	1385	2.00024	3.42753	29.8079
8804.38	1160	1.99871	3.10818	29.7936	9965.21	1390	2.00027	3.43438	29.8081
8830.67	1165	1.99875	3.11553	29.794	9989.41	1395	2.0003	3.44122	29.8084
8856.91	1170	1.99879	3.12287	29.7943	10013.6	1400	2.00033	3.44806	29.8087
8883.1	1175	1.99883	3.1302	29.7947	10037.7	1405	2.00036	3.45488	29.809
8909.24	1180	1.99887	3.13752	29.795					
8935.33	1185	1.99891	3.14482	29.7954					
8961.38	1190	1.99894	3.15211	29.7957					
8987.37	1195	1.99898	3.15939	29.7961					
9013.32	1200	1.99902	3.16666	29.7964					
9039.21	1205	1.99905	3.17391	29.7968					
9065.06	1210	1.99909	3.18115	29.7971					
9090.86	1215	1.99913	3.18838	29.7975					

México, 2015

Ilustración 60.- Iteración 9 de Levenberg-Marquardt para Suelo Limo.

Tabla 15. Novena iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 9				
0	0	0	0	0
146.328	5	1.12875	0.17599	146.328
266.567	10	1.40722	0.269387	19.8563
346.198	15	1.54293	0.33165	24.6163
405.068	20	1.63156	0.382842	26.1498
470.396	25	1.69448	0.427595	27.0097
537.055	30	1.74135	0.467964	27.5588
600.978	35	1.77737	0.505083	27.9389
663.022	40	1.8057	0.539665	28.2159
724.407	45	1.82844	0.57219	28.4252
784.915	50	1.84704	0.603004	28.588
844.353	55	1.86247	0.632363	28.7176
902.871	60	1.87545	0.660466	28.8231
960.61	65	1.88649	0.687469	28.9103
1017.61	70	1.89595	0.713498	28.9836
1073.89	75	1.90414	0.738658	29.046
1129.53	80	1.91128	0.763035	29.0995
1184.55	85	1.91753	0.786701	29.1461
1239	90	1.92305	0.809719	29.1868
1292.9	95	1.92794	0.832143	29.2227

Iteración Levenberg-Marquardt 9				
1346.3	100	1.93229	0.854019	29.2545
1399.2	105	1.93618	0.875387	29.283
1451.64	110	1.93968	0.896285	29.3086
1503.64	115	1.94283	0.916743	29.3317
1555.22	120	1.94568	0.93679	29.3526
1606.39	125	1.94826	0.956452	29.3716
1657.17	130	1.95061	0.975751	29.389
1707.57	135	1.95276	0.994709	29.405
1757.61	140	1.95473	1.01334	29.4197
1807.3	145	1.95654	1.03167	29.4334
1856.65	150	1.95821	1.04971	29.446
1905.68	155	1.95975	1.06748	29.4577
1954.38	160	1.96118	1.08498	29.4686
2002.78	165	1.9625	1.10223	29.4788
2050.88	170	1.96373	1.11924	29.4884
2098.68	175	1.96488	1.13602	29.4974
2146.2	180	1.96596	1.15259	29.5058
2193.44	185	1.96697	1.16895	29.5138
2240.4	190	1.96792	1.1851	29.5214
2287.11	195	1.96881	1.20106	29.5285

Iteración Levenberg-Marquardt 9				
2333.55	200	1.96965	1.21684	29.5353
2379.74	205	1.97045	1.23243	29.5418
2425.68	210	1.9712	1.24786	29.5479
2471.38	215	1.97191	1.26312	29.5538
2516.84	220	1.97259	1.27821	29.5594
2562.07	225	1.97324	1.29316	29.5647
2607.06	230	1.97385	1.30795	29.5699
2651.84	235	1.97444	1.3226	29.5748
2696.39	240	1.975	1.3371	29.5795
2740.72	245	1.97554	1.35147	29.584
2784.84	250	1.97605	1.36571	29.5884
2828.75	255	1.97655	1.37982	29.5926
2872.46	260	1.97702	1.39381	29.5967
2915.96	265	1.97748	1.40768	29.6006
2959.26	270	1.97792	1.42143	29.6044
3002.37	275	1.97834	1.43506	29.6081
3045.28	280	1.97875	1.44858	29.6116
3088	285	1.97915	1.462	29.615
3130.53	290	1.97953	1.47531	29.6184
3172.88	295	1.9799	1.48852	29.6216
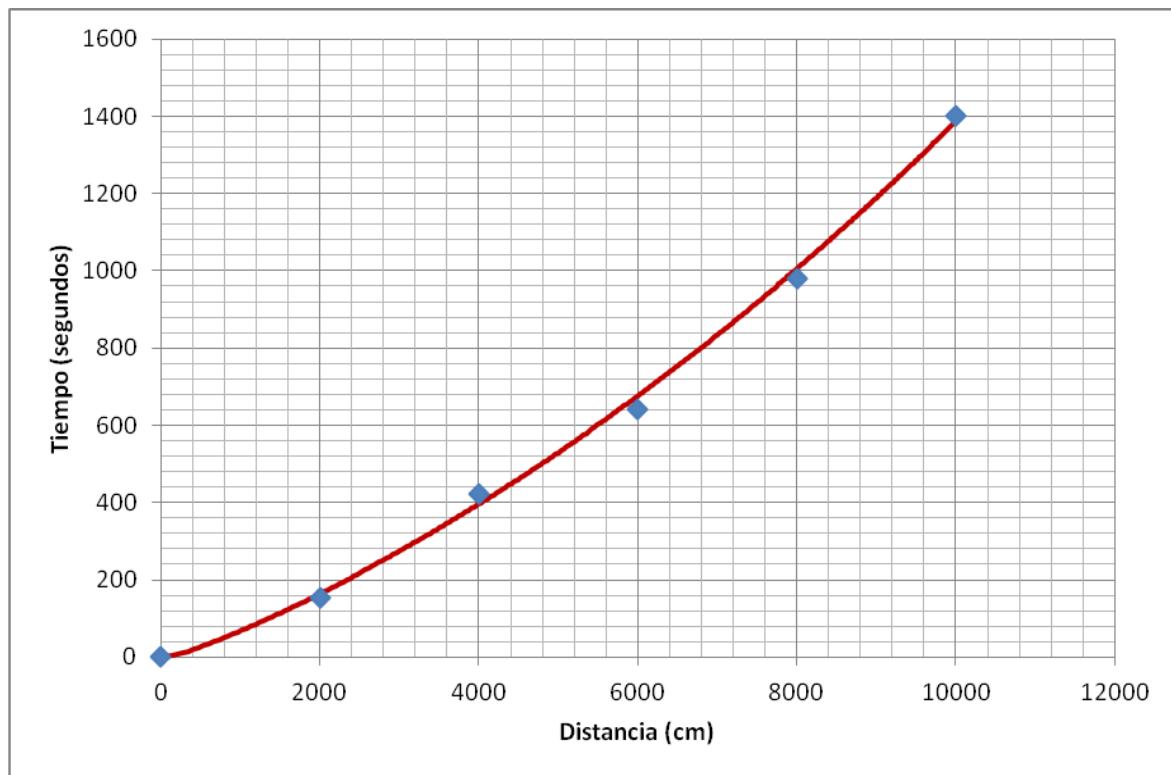
Iteración Levenberg-Marquardt 9				
3215.05	300	1.98025	1.50163	29.6247
3257.03	305	1.9806	1.51464	29.6278
3298.84	310	1.98094	1.52755	29.6308
3340.47	315	1.98126	1.54038	29.6336
3381.93	320	1.98158	1.55311	29.6364
3423.22	325	1.98189	1.56576	29.6392
3464.35	330	1.98219	1.57831	29.6418
3505.3	335	1.98248	1.59079	29.6444
3546.09	340	1.98276	1.60318	29.6469
3586.72	345	1.98304	1.61549	29.6494
3627.19	350	1.9833	1.62772	29.6518
3667.5	355	1.98357	1.63988	29.6542
3707.66	360	1.98382	1.65196	29.6565
3747.66	365	1.98407	1.66396	29.6587
3787.5	370	1.98432	1.67589	29.6609
3827.2	375	1.98455	1.68775	29.663
3866.75	380	1.98479	1.69955	29.6651
3906.15	385	1.98501	1.71127	29.6672
3945.4	390	1.98524	1.72293	29.6692
3984.51	395	1.98545	1.73452	29.6712
4023.48	400	1.98567	1.74604	29.6731
4062.31	405	1.98587	1.75751	29.675
4100.99	410	1.98608	1.76891	29.6768
4139.54	415	1.98628	1.78025	29.6787
4177.95	420	1.98647	1.79153	29.6804
4216.23	425	1.98667	1.80275	29.6822
4254.37	430	1.98685	1.81391	29.6839
4292.38	435	1.98704	1.82502	29.6856
4330.26	440	1.98722	1.83607	29.6872
4368.01	445	1.9874	1.84707	29.6889
4405.63	450	1.98757	1.85801	29.6904
4443.13	455	1.98774	1.8689	29.692
4480.49	460	1.98791	1.87974	29.6935
4517.74	465	1.98808	1.89052	29.6951
4554.86	470	1.98824	1.90126	29.6965
4591.85	475	1.9884	1.91195	29.698
4628.73	480	1.98856	1.92258	29.6994
4665.48	485	1.98871	1.93317	29.7009
4702.12	490	1.98886	1.94372	29.7022
4738.63	495	1.98901	1.95421	29.7036
4775.03	500	1.98916	1.96466	29.705
4811.32	505	1.9893	1.97506	29.7063
4847.49	510	1.98945	1.98542	29.7076
4883.54	515	1.98958	1.99574	29.7089
4919.49	520	1.98972	2.00601	29.7101
4955.32	525	1.98986	2.01624	29.7114

Iteración Levenberg-Marquardt 9				
4991.04	530	1.98999	2.02643	29.7126
5026.65	535	1.99012	2.03658	29.7138
5062.15	540	1.99025	2.04668	29.715
5097.54	545	1.99038	2.05675	29.7162
5132.83	550	1.99051	2.06677	29.7173
5168.01	555	1.99063	2.07676	29.7185
5203.08	560	1.99075	2.08671	29.7196
5238.05	565	1.99087	2.09662	29.7207
5272.91	570	1.99099	2.10649	29.7218
5307.68	575	1.99111	2.11632	29.7229
5342.34	580	1.99122	2.12612	29.7239
5376.9	585	1.99134	2.13588	29.725
5411.35	590	1.99145	2.14561	29.726
5445.71	595	1.99156	2.1553	29.727
5479.97	600	1.99167	2.16496	29.7281
5514.14	605	1.99178	2.17458	29.7291
5548.2	610	1.99188	2.18417	29.73
5582.17	615	1.99199	2.19372	29.731
5616.04	620	1.99209	2.20324	29.732
5649.82	625	1.99219	2.21273	29.7329
5683.5	630	1.9923	2.22219	29.7338
5717.09	635	1.9924	2.23161	29.7348
5750.59	640	1.99249	2.241	29.7357
5783.99	645	1.99259	2.25036	29.7366
5817.3	650	1.99269	2.2597	29.7375
5850.53	655	1.99278	2.269	29.7383
5883.66	660	1.99288	2.27826	29.7392
5916.7	665	1.99297	2.2875	29.7401
5949.65	670	1.99306	2.29672	29.7409
5982.52	675	1.99315	2.3059	29.7418
6015.29	680	1.99324	2.31505	29.7426
6047.98	685	1.99333	2.32417	29.7434
6080.59	690	1.99342	2.33327	29.7442
6113.1	695	1.9935	2.34234	29.745
6145.53	700	1.99359	2.35138	29.7458
6177.88	705	1.99367	2.36039	29.7466
6210.15	710	1.99376	2.36938	29.7474
6242.32	715	1.99384	2.37834	29.7481
6274.42	720	1.99392	2.38727	29.7489
6306.44	725	1.994	2.39618	29.7497
6338.37	730	1.99408	2.40506	29.7504
6370.22	735	1.99416	2.41391	29.7511
6401.99	740	1.99424	2.42274	29.7519
6433.68	745	1.99432	2.43155	29.7526
6465.29	750	1.99439	2.44033	29.7533
6496.82	755	1.99447	2.44908	29.754

Iteración Levenberg-Marquardt 9				
6528.28	760	1.99455	2.45781	29.7547
6559.65	765	1.99462	2.46652	29.7554
6590.95	770	1.99469	2.4752	29.7561
6622.17	775	1.99477	2.48386	29.7567
6653.31	780	1.99484	2.4925	29.7574
6684.38	785	1.99491	2.50111	29.7581
6715.37	790	1.99498	2.5097	29.7587
6746.29	795	1.99505	2.51827	29.7594
6777.13	800	1.99512	2.52681	29.76
6807.9	805	1.99519	2.53533	29.7607
6838.59	810	1.99526	2.54383	29.7613
6869.21	815	1.99532	2.55231	29.7619
6899.76	820	1.99539	2.56077	29.7625
6930.23	825	1.99546	2.5692	29.7632
6960.64	830	1.99552	2.57762	29.7638
6990.97	835	1.99559	2.58601	29.7644
7021.23	840	1.99565	2.59438	29.765
7051.42	845	1.99571	2.60273	29.7656
7081.54	850	1.99578	2.61106	29.7661
7111.59	855	1.99584	2.61937	29.7667
7141.57	860	1.9959	2.62766	29.7673
7171.48	865	1.99596	2.63593	29.7679
7201.32	870	1.99602	2.64418	29.7684
7231.1	875	1.99608	2.65241	29.769
7260.8	880	1.99614	2.66062	29.7695
7290.44	885	1.9962	2.66881	29.7701
7320.01	890	1.99626	2.67698	29.7706
7349.52	895	1.99632	2.68514	29.7712
7378.96	900	1.99638	2.69327	29.7717
7408.33	905	1.99643	2.70139	29.7723
7437.64	910	1.99649	2.70948	29.7728
7466.88	915	1.99655	2.71756	29.7733
7496.06	920	1.9966	2.72562	29.7738
7525.18	925	1.99666	2.73366	29.7743
7554.23	930	1.99671	2.74169	29.7749
7583.21	935	1.99677	2.7497	29.7754
7612.14	940	1.99682	2.75768	29.7759
7641	945	1.99687	2.76566	29.7764
7669.79	950	1.99693	2.77361	29.7769
7698.53	955	1.99698	2.78155	29.7773
7727.2	960	1.99703	2.78947	29.7778
7755.81	965	1.99708	2.79737	29.7783
7784.36	970	1.99714	2.80525	29.7788
7812.85	975	1.99719	2.81312	29.7793
7841.28	980	1.99724	2.82098	29.7797
7869.65	985	1.99729	2.82881	29.7802

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Iteración Levenberg-Marquardt 9				
7897.96	990	1.99734	2.83663	29.7807
7926.21	995	1.99739	2.84443	29.7811
7954.4	1000	1.99743	2.85222	29.7816
7982.53	1005	1.99748	2.85999	29.782
8010.6	1010	1.99753	2.86775	29.7825
8038.61	1015	1.99758	2.87549	29.7829
8066.57	1020	1.99763	2.88321	29.7834
8094.46	1025	1.99767	2.89092	29.7838
8122.3	1030	1.99772	2.89861	29.7842
8150.09	1035	1.99777	2.90629	29.7847
8177.81	1040	1.99781	2.91396	29.7851
8205.48	1045	1.99786	2.9216	29.7855
8233.09	1050	1.9979	2.92924	29.786
8260.65	1055	1.99795	2.93685	29.7864
8288.15	1060	1.99799	2.94446	29.7868
8315.6	1065	1.99804	2.95205	29.7872
8342.99	1070	1.99808	2.95962	29.7876
8370.32	1075	1.99813	2.96718	29.788
8397.6	1080	1.99817	2.97473	29.7884
8424.83	1085	1.99821	2.98226	29.7888
8452	1090	1.99826	2.98977	29.7892
8479.12	1095	1.9983	2.99728	29.7896
8506.19	1100	1.99834	3.00477	29.79
8533.2	1105	1.99838	3.01224	29.7904
8560.16	1110	1.99842	3.0197	29.7908
8587.06	1115	1.99846	3.02715	29.7912
8613.92	1120	1.99851	3.03459	29.7916
8640.72	1125	1.99855	3.04201	29.7919
8667.47	1130	1.99859	3.04941	29.7923
8694.16	1135	1.99863	3.05681	29.7927
8720.81	1140	1.99867	3.06419	29.7931
8747.4	1145	1.99871	3.07156	29.7934
8773.95	1150	1.99875	3.07891	29.7938
8800.44	1155	1.99879	3.08626	29.7942
8826.88	1160	1.99882	3.09358	29.7945
8853.27	1165	1.99886	3.1009	29.7949
8879.61	1170	1.9989	3.1082	29.7953
8905.9	1175	1.99894	3.1155	29.7956
8932.15	1180	1.99898	3.12277	29.796
8958.34	1185	1.99901	3.13004	29.7963
8984.48	1190	1.99905	3.13729	29.7967
9010.58	1195	1.99909	3.14454	29.797
9036.62	1200	1.99913	3.15177	29.7974
9062.62	1205	1.99916	3.15898	29.7977
9088.57	1210	1.9992	3.16619	29.798
9114.47	1215	1.99924	3.17338	29.7984

Iteración Levenberg-Marquardt 9				
9140.32	1220	1.99927	3.18056	29.7987
9166.13	1225	1.99931	3.18773	29.7991
9191.88	1230	1.99934	3.19489	29.7994
9217.59	1235	1.99938	3.20204	29.7997
9243.26	1240	1.99941	3.20917	29.8
9268.88	1245	1.99945	3.21629	29.8004
9294.45	1250	1.99948	3.2234	29.8007
9319.97	1255	1.99952	3.2305	29.801
9345.45	1260	1.99955	3.23759	29.8013
9370.88	1265	1.99958	3.24467	29.8016
9396.27	1270	1.99962	3.25174	29.802
9421.61	1275	1.99965	3.25879	29.8023
9446.9	1280	1.99969	3.26583	29.8026
9472.15	1285	1.99972	3.27287	29.8029
9497.36	1290	1.99975	3.27989	29.8032
9522.52	1295	1.99978	3.2869	29.8035
9547.63	1300	1.99982	3.2939	29.8038
9572.7	1305	1.99985	3.30089	29.8041
9597.73	1310	1.99988	3.30787	29.8044
9622.71	1315	1.99991	3.31484	29.8047
9647.65	1320	1.99995	3.32179	29.805
9672.55	1325	1.99998	3.32874	29.8053
9697.4	1330	2.00001	3.33568	29.8056
9722.21	1335	2.00004	3.3426	29.8059
9746.98	1340	2.00007	3.34952	29.8062
9771.7	1345	2.0001	3.35643	29.8065
9796.38	1350	2.00013	3.36332	29.8068
9821.02	1355	2.00016	3.37021	29.8071
9845.61	1360	2.00019	3.37708	29.8073
9870.16	1365	2.00022	3.38395	29.8076
9894.68	1370	2.00025	3.3908	29.8079
9919.14	1375	2.00028	3.39765	29.8082
9943.57	1380	2.00031	3.40448	29.8085
9967.96	1385	2.00034	3.41131	29.8087
9992.3	1390	2.00037	3.41812	29.809
10016.6	1395	2.0004	3.42493	29.8093
10040.9	1400	2.00043	3.43173	29.8096

Ilustración 61.- Iteración 10 de Levenberg-Marquardt para Suelo Limo.

Tabla 16. Décima iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 10						Iteración Levenberg-Marquardt 10						Iteración Levenberg-Marquardt 10			
0	0	0	0	0		1347.46	100	1.93253	0.850829	29.2566		2336.14	200	1.96983	1.21224	29.5369
146.396	5	1.12881	0.175345	146.396		1400.43	105	1.93642	0.872115	29.285		2382.41	205	1.97063	1.22777	29.5433
266.7	10	1.4073	0.2684	19.8601		1452.94	110	1.93991	0.892932	29.3106		2428.43	210	1.97138	1.24314	29.5494
346.395	15	1.54305	0.330433	24.6189		1505	115	1.94305	0.913311	29.3336		2474.2	215	1.97209	1.25833	29.5553
405.309	20	1.63172	0.381434	26.1524		1556.65	120	1.9459	0.933281	29.3545		2519.74	220	1.97277	1.27337	29.5609
470.677	25	1.69467	0.426021	27.0122		1607.89	125	1.94848	0.952867	29.3735		2565.04	225	1.97341	1.28826	29.5662
537.386	30	1.74157	0.466239	27.5613		1658.73	130	1.95083	0.972092	29.3909		2610.12	230	1.97402	1.30299	29.5713
601.363	35	1.7776	0.503219	27.9414		1709.21	135	1.95298	0.990976	29.4069		2654.97	235	1.97461	1.31758	29.5762
663.459	40	1.80594	0.537671	28.2185		1759.32	140	1.95494	1.00954	29.4216		2699.6	240	1.97517	1.33203	29.5809
724.898	45	1.82869	0.570073	28.4278		1809.08	145	1.95675	1.0278	29.4351		2744.01	245	1.97571	1.34634	29.5855
785.461	50	1.84729	0.600771	28.5905		1858.5	150	1.95841	1.04577	29.4477		2788.21	250	1.97622	1.36052	29.5898
844.957	55	1.86273	0.630019	28.7201		1907.6	155	1.95995	1.06346	29.4594		2832.2	255	1.97671	1.37458	29.594
903.533	60	1.87571	0.658015	28.8255		1956.38	160	1.96138	1.08089	29.4703		2875.99	260	1.97718	1.38851	29.5981
961.331	65	1.88674	0.684915	28.9127		2004.85	165	1.9627	1.09808	29.4805		2919.57	265	1.97764	1.40232	29.602
1018.39	70	1.89621	0.710846	28.986		2053.02	170	1.96393	1.11502	29.4901		2962.95	270	1.97808	1.41602	29.6058
1074.74	75	1.90439	0.73591	29.0482		2100.89	175	1.96508	1.13174	29.499		3006.14	275	1.9785	1.4296	29.6094
1130.43	80	1.91153	0.760193	29.1018		2148.49	180	1.96615	1.14824	29.5075		3049.13	280	1.97891	1.44307	29.613
1185.52	85	1.91778	0.783769	29.1482		2195.8	185	1.96716	1.16453	29.5154		3091.93	285	1.9793	1.45643	29.6164
1240.03	90	1.92329	0.806699	29.1889		2242.84	190	1.9681	1.18062	29.523		3134.55	290	1.97968	1.46969	29.6197
1294	95	1.92818	0.829037	29.2248		2289.62	195	1.96899	1.19652	29.5301		3176.98	295	1.98005	1.48284	29.6229
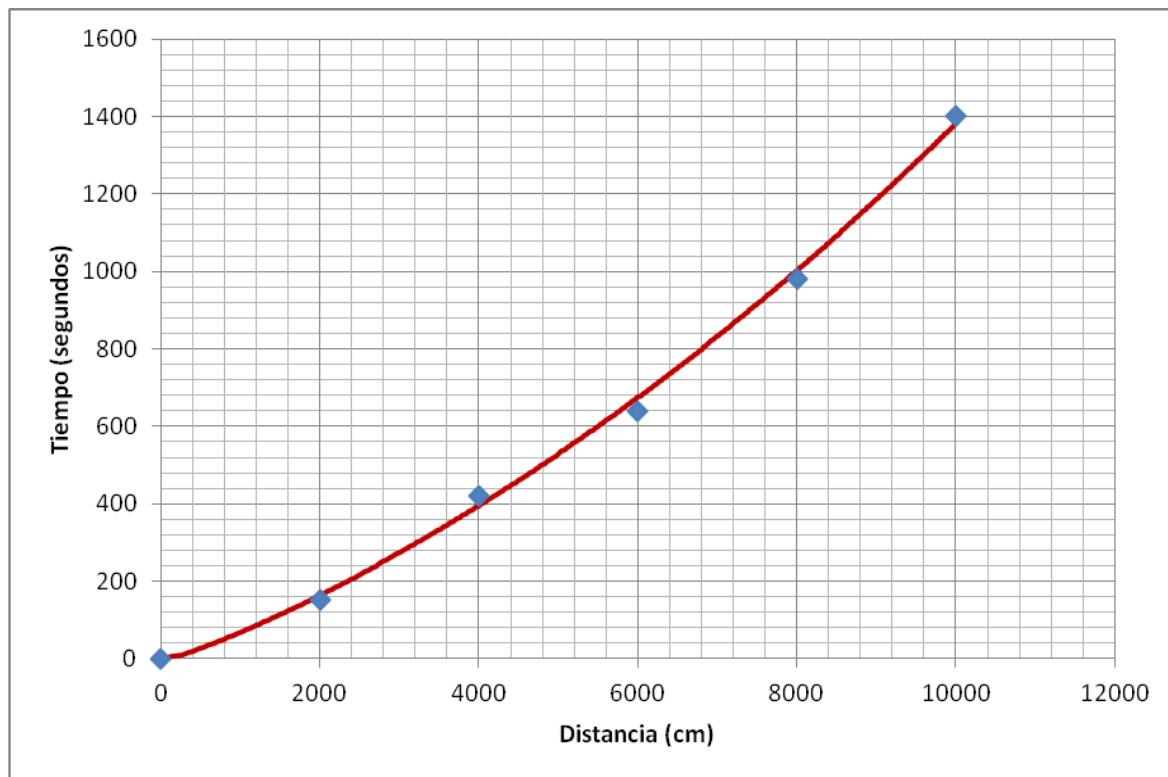
Iteración Levenberg-Marquardt 10			
3219.23	300	1.98041	1.4959	29.6261
3261.29	305	1.98075	1.50886	29.6291
3303.18	310	1.98109	1.52172	29.632
3344.9	315	1.98141	1.53449	29.6349
3386.44	320	1.98173	1.54718	29.6377
3427.81	325	1.98203	1.55977	29.6404
3469.02	330	1.98233	1.57228	29.6431
3510.06	335	1.98262	1.5847	29.6457
3550.93	340	1.9829	1.59704	29.6482
3591.64	345	1.98318	1.6093	29.6506
3632.2	350	1.98345	1.62149	29.653
3672.59	355	1.98371	1.63359	29.6554
3712.83	360	1.98396	1.64562	29.6577
3752.91	365	1.98421	1.65758	29.6599
3792.84	370	1.98446	1.66946	29.6621
3832.63	375	1.98469	1.68128	29.6642
3872.26	380	1.98492	1.69302	29.6663
3911.74	385	1.98515	1.7047	29.6684
3951.08	390	1.98537	1.71631	29.6704
3990.28	395	1.98559	1.72785	29.6723
4029.33	400	1.9858	1.73933	29.6743
4068.24	405	1.98601	1.75075	29.6761
4107.01	410	1.98621	1.7621	29.678
4145.65	415	1.98641	1.7734	29.6798
4184.15	420	1.98661	1.78463	29.6816
4222.51	425	1.9868	1.79581	29.6833
4260.74	430	1.98699	1.80692	29.685
4298.83	435	1.98717	1.81799	29.6867
4336.8	440	1.98735	1.82899	29.6883
4374.63	445	1.98753	1.83994	29.69
4412.34	450	1.9877	1.85084	29.6916
4449.92	455	1.98787	1.86169	29.6931
4487.37	460	1.98804	1.87248	29.6946
4524.7	465	1.98821	1.88322	29.6962
4561.91	470	1.98837	1.89392	29.6976
4598.99	475	1.98853	1.90456	29.6991
4635.95	480	1.98868	1.91515	29.7005
4672.79	485	1.98884	1.9257	29.7019
4709.52	490	1.98899	1.9362	29.7033
4746.12	495	1.98914	1.94665	29.7047
4782.61	500	1.98928	1.95706	29.706
4818.98	505	1.98943	1.96742	29.7073
4855.23	510	1.98957	1.97774	29.7086
4891.38	515	1.98971	1.98801	29.7099
4927.41	520	1.98984	1.99824	29.7112
4963.32	525	1.98998	2.00843	29.7124
4999.13	530	1.99011	2.01857	29.7136
5034.83	535	1.99024	2.02868	29.7148
5070.42	540	1.99037	2.03874	29.716
5105.9	545	1.9905	2.04877	29.7172
5141.27	550	1.99063	2.05875	29.7184
5176.54	555	1.99075	2.0687	29.7195
5211.7	560	1.99087	2.0786	29.7206
5246.75	565	1.99099	2.08847	29.7217
5281.71	570	1.99111	2.0983	29.7228
5316.56	575	1.99123	2.1081	29.7239
5351.31	580	1.99134	2.11786	29.7249
5385.95	585	1.99145	2.12758	29.726
5420.5	590	1.99157	2.13726	29.727
5454.95	595	1.99168	2.14691	29.728
5489.29	600	1.99178	2.15653	29.729
5523.54	605	1.99189	2.16611	29.73
5557.7	610	1.992	2.17566	29.731
5591.75	615	1.9921	2.18518	29.732
5625.71	620	1.99221	2.19466	29.7329
5659.58	625	1.99231	2.20411	29.7339
5693.35	630	1.99241	2.21352	29.7348
5727.03	635	1.99251	2.22291	29.7357
5760.61	640	1.99261	2.23226	29.7366
5794.1	645	1.9927	2.24158	29.7375
5827.5	650	1.9928	2.25088	29.7384
5860.81	655	1.99289	2.26014	29.7393
5894.03	660	1.99299	2.26937	29.7402
5927.16	665	1.99308	2.27857	29.741
5960.2	670	1.99317	2.28774	29.7419
5993.16	675	1.99326	2.29688	29.7427
6026.02	680	1.99335	2.306	29.7435
6058.8	685	1.99344	2.31508	29.7444
6091.49	690	1.99353	2.32414	29.7452
6124.09	695	1.99361	2.33317	29.746
6156.61	700	1.9937	2.34218	29.7468
6189.05	705	1.99378	2.35115	29.7475
6221.4	710	1.99387	2.3601	29.7483
6253.67	715	1.99395	2.36902	29.7491
6285.85	720	1.99403	2.37792	29.7498
6317.96	725	1.99411	2.38679	29.7506
6349.98	730	1.99419	2.39563	29.7513
6381.92	735	1.99427	2.40445	29.7521
6413.78	740	1.99435	2.41324	29.7528
6445.55	745	1.99442	2.42201	29.7535
6477.25	750	1.9945	2.43075	29.7542
6508.87	755	1.99458	2.43947	29.7549
6540.41	760	1.99465	2.44817	29.7556
6571.88	765	1.99473	2.45684	29.7563
6603.26	770	1.9948	2.46548	29.757
6634.57	775	1.99487	2.47411	29.7576
6665.8	780	1.99494	2.4827	29.7583
6696.96	785	1.99501	2.49128	29.759
6728.04	790	1.99509	2.49984	29.7596
6759.04	795	1.99516	2.50837	29.7603
6789.97	800	1.99522	2.51687	29.7609
6820.83	805	1.99529	2.52536	29.7616
6851.61	810	1.99536	2.53383	29.7622
6882.32	815	1.99543	2.54227	29.7628
6912.95	820	1.99549	2.55069	29.7634
6943.51	825	1.99556	2.55909	29.764
6974.01	830	1.99563	2.56747	29.7646
7004.42	835	1.99569	2.57582	29.7652
7034.77	840	1.99575	2.58416	29.7658
7065.05	845	1.99582	2.59247	29.7664
7095.26	850	1.99588	2.60077	29.767
7125.4	855	1.99594	2.60904	29.7676
7155.46	860	1.996	2.6173	29.7682
7185.46	865	1.99606	2.62553	29.7687
7215.39	870	1.99613	2.63375	29.7693
7245.26	875	1.99619	2.64194	29.7699
7275.05	880	1.99625	2.65012	29.7704
7304.78	885	1.9963	2.65828	29.771
7334.44	890	1.99636	2.66641	29.7715
7364.03	895	1.99642	2.67453	29.772
7393.56	900	1.99648	2.68263	29.7726
7423.02	905	1.99653	2.69071	29.7731
7452.42	910	1.99659	2.69878	29.7736
7481.75	915	1.99665	2.70682	29.7742
7511.01	920	1.9967	2.71485	29.7747
7540.21	925	1.99676	2.72285	29.7752
7569.35	930	1.99681	2.73084	29.7757
7598.43	935	1.99687	2.73882	29.7762
7627.44	940	1.99692	2.74677	29.7767
7656.38	945	1.99697	2.75471	29.7772
7685.27	950	1.99703	2.76263	29.7777
7714.09	955	1.99708	2.77053	29.7782
7742.85	960	1.99713	2.77842	29.7787
7771.55	965	1.99718	2.78629	29.7791
7800.19	970	1.99723	2.79414	29.7796
7828.76	975	1.99728	2.80197	29.7801
7857.28	980	1.99733	2.80979	29.7806
7885.74	985	1.99738	2.8176	29.781

Iteración Levenberg-Marquardt 10						Iteración Levenberg-Marquardt 10			
7914.13	990	1.99743	2.82538	29.7815		9160.47	1220	1.99936	3.16784	29.7995
7942.47	995	1.99748	2.83315	29.7819		9186.36	1225	1.9994	3.17497	29.7998
7970.74	1000	1.99753	2.84091	29.7824		9212.2	1230	1.99943	3.1821	29.8002
7998.96	1005	1.99758	2.84864	29.7829		9238	1235	1.99947	3.18922	29.8005
8027.12	1010	1.99763	2.85637	29.7833		9263.75	1240	1.9995	3.19632	29.8008
8055.22	1015	1.99768	2.86407	29.7837		9289.45	1245	1.99954	3.20341	29.8011
8083.26	1020	1.99772	2.87176	29.7842		9315.11	1250	1.99957	3.21049	29.8015
8111.25	1025	1.99777	2.87944	29.7846		9340.72	1255	1.99961	3.21756	29.8018
8139.17	1030	1.99782	2.8871	29.7851		9366.28	1260	1.99964	3.22462	29.8021
8167.04	1035	1.99786	2.89475	29.7855		9391.8	1265	1.99967	3.23167	29.8024
8194.86	1040	1.99791	2.90238	29.7859		9417.27	1270	1.99971	3.2387	29.8027
8222.61	1045	1.99795	2.90999	29.7863		9442.69	1275	1.99974	3.24573	29.803
8250.31	1050	1.998	2.91759	29.7868		9468.07	1280	1.99977	3.25274	29.8034
8277.96	1055	1.99804	2.92518	29.7872		9493.41	1285	1.99981	3.25974	29.8037
8305.54	1060	1.99809	2.93275	29.7876		9518.7	1290	1.99984	3.26673	29.804
8333.08	1065	1.99813	2.9403	29.788		9543.94	1295	1.99987	3.27371	29.8043
8360.55	1070	1.99818	2.94785	29.7884		9569.14	1300	1.99991	3.28068	29.8046
8387.98	1075	1.99822	2.95537	29.7888		9594.3	1305	1.99994	3.28764	29.8049
8415.34	1080	1.99826	2.96289	29.7892		9619.41	1310	1.99997	3.29459	29.8052
8442.66	1085	1.99831	2.97039	29.7896		9644.48	1315	2	3.30153	29.8055
8469.92	1090	1.99835	2.97787	29.79		9669.5	1320	2.00003	3.30846	29.8058
8497.12	1095	1.99839	2.98534	29.7904		9694.48	1325	2.00007	3.31537	29.8061
8524.27	1100	1.99843	2.9928	29.7908		9719.42	1330	2.0001	3.32228	29.8064
8551.37	1105	1.99848	3.00024	29.7912		9744.32	1335	2.00013	3.32918	29.8067
8578.41	1110	1.99852	3.00767	29.7916		9769.17	1340	2.00016	3.33606	29.8069
8605.41	1115	1.99856	3.01509	29.792		9793.97	1345	2.00019	3.34294	29.8072
8632.35	1120	1.9986	3.02249	29.7924		9818.74	1350	2.00022	3.3498	29.8075
8659.23	1125	1.99864	3.02988	29.7927		9843.46	1355	2.00025	3.35666	29.8078
8686.07	1130	1.99868	3.03725	29.7931		9868.14	1360	2.00028	3.3635	29.8081
8712.85	1135	1.99872	3.04462	29.7935		9892.78	1365	2.00031	3.37034	29.8084
8739.58	1140	1.99876	3.05197	29.7939		9917.37	1370	2.00034	3.37716	29.8087
8766.26	1145	1.9988	3.0593	29.7942		9941.93	1375	2.00037	3.38398	29.8089
8792.89	1150	1.99884	3.06663	29.7946		9966.44	1380	2.0004	3.39078	29.8092
8819.47	1155	1.99888	3.07394	29.795		9990.91	1385	2.00043	3.39758	29.8095
8846	1160	1.99892	3.08123	29.7953		10015.3	1390	2.00046	3.40437	29.8098
8872.48	1165	1.99895	3.08852	29.7957		10039.7	1395	2.00049	3.41114	29.81
8898.9	1170	1.99899	3.09579	29.796						
8925.28	1175	1.99903	3.10305	29.7964						
8951.61	1180	1.99907	3.1103	29.7968						
8977.89	1185	1.99911	3.11753	29.7971						
9004.12	1190	1.99914	3.12476	29.7975						
9030.3	1195	1.99918	3.13197	29.7978						
9056.43	1200	1.99922	3.13916	29.7981						
9082.51	1205	1.99925	3.14635	29.7985						
9108.55	1210	1.99929	3.15352	29.7988						
9134.53	1215	1.99933	3.16069	29.7992						

México, 2015

Ilustración 62.- Iteración 11 de Levenberg-Marquardt para Suelo Limo.

Tabla 17. Décimo primera iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 11					Iteración Levenberg-Marquardt 11					Iteración Levenberg-Marquardt 11				
0	0	0	0	0	1348.51	100	1.93274	0.84793	29.2585	2338.5	200	1.97	1.20806	29.5383
146.457	5	1.12887	0.174758	146.457	1401.55	105	1.93663	0.869142	29.2869	2384.84	205	1.97079	1.22354	29.5447
266.82	10	1.40737	0.267502	19.8635	1454.12	110	1.94012	0.889886	29.3124	2430.92	210	1.97154	1.23885	29.5508
346.574	15	1.54317	0.329327	24.6213	1506.24	115	1.94326	0.910193	29.3354	2476.77	215	1.97225	1.25399	29.5567
405.527	20	1.63186	0.380155	26.1547	1557.95	120	1.9461	0.930093	29.3563	2522.38	220	1.97293	1.26897	29.5622
470.933	25	1.69484	0.42459	27.0145	1609.25	125	1.94868	0.94961	29.3753	2567.75	225	1.97357	1.2838	29.5676
537.687	30	1.74176	0.464671	27.5636	1660.16	130	1.95103	0.968767	29.3926	2612.9	230	1.97418	1.29848	29.5727
601.713	35	1.77781	0.501525	27.9437	1710.7	135	1.95317	0.987584	29.4086	2657.82	235	1.97476	1.31302	29.5775
663.857	40	1.80616	0.535858	28.2208	1760.87	140	1.95514	1.00608	29.4232	2702.52	240	1.97532	1.32742	29.5822
725.344	45	1.82891	0.56815	28.43	1810.7	145	1.95694	1.02427	29.4368	2747.01	245	1.97586	1.34168	29.5868
785.959	50	1.84752	0.598741	28.5927	1860.19	150	1.9586	1.04218	29.4493	2791.28	250	1.97637	1.35581	29.5911
845.506	55	1.86296	0.627888	28.7223	1909.35	155	1.96014	1.05981	29.461	2835.34	255	1.97686	1.36982	29.5953
904.135	60	1.87594	0.655788	28.8277	1958.19	160	1.96156	1.07718	29.4719	2879.2	260	1.97733	1.3837	29.5993
961.988	65	1.88697	0.682595	28.9149	2006.73	165	1.96288	1.09431	29.4821	2922.86	265	1.97779	1.39746	29.6032
1019.1	70	1.89644	0.708436	28.9881	2054.97	170	1.96411	1.11119	29.4916	2966.31	270	1.97822	1.4111	29.607
1075.5	75	1.90462	0.733412	29.0503	2102.91	175	1.96525	1.12785	29.5005	3009.57	275	1.97864	1.42463	29.6107
1131.25	80	1.91175	0.757611	29.1038	2150.57	180	1.96633	1.14429	29.509	3052.64	280	1.97905	1.43805	29.6142
1186.4	85	1.918	0.781105	29.1502	2197.95	185	1.96733	1.16052	29.5169	3095.51	285	1.97944	1.45137	29.6176
1240.97	90	1.92351	0.803955	29.1909	2245.06	190	1.96827	1.17656	29.5244	3138.2	290	1.97982	1.46458	29.6209
1295	95	1.92839	0.826215	29.2267	2291.91	195	1.96916	1.1924	29.5315	3180.71	295	1.98019	1.47768	29.6241
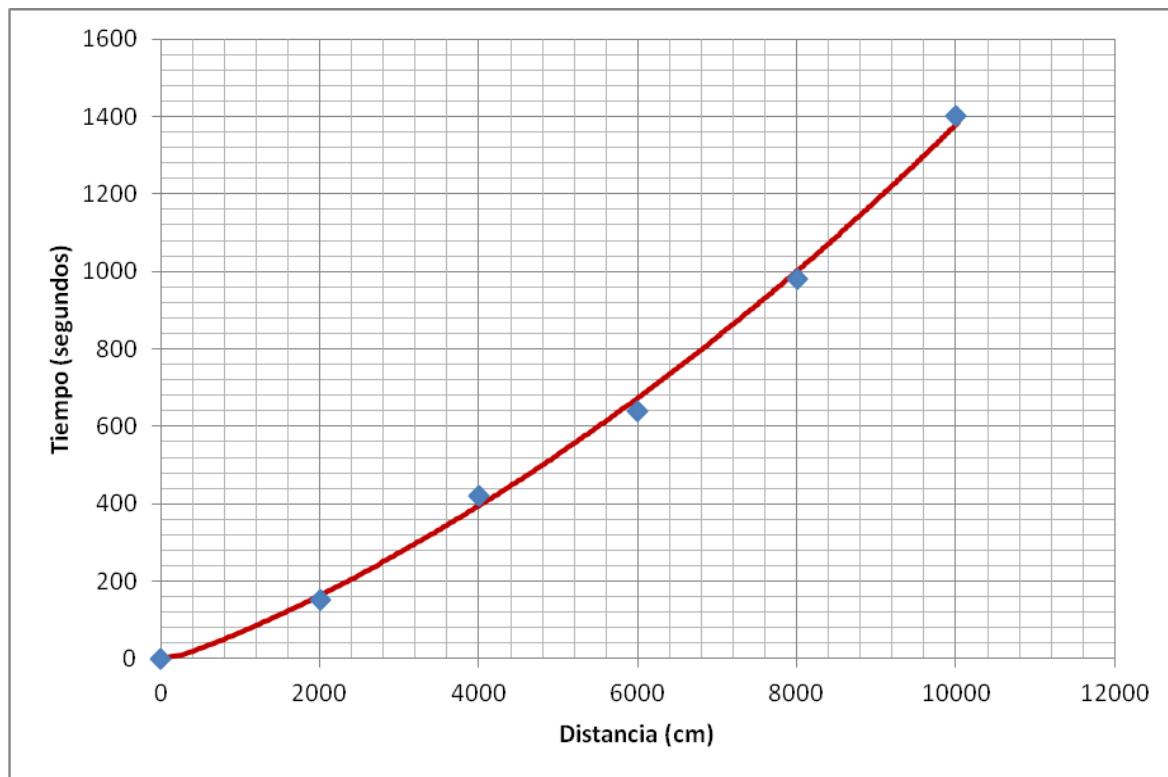
Iteración Levenberg-Marquardt 11				
3223.03	300	1.98054	1.49069	29.6272
3265.17	305	1.98089	1.5036	29.6303
3307.14	310	1.98122	1.51642	29.6332
3348.93	315	1.98155	1.52915	29.6361
3390.54	320	1.98186	1.54178	29.6389
3431.99	325	1.98217	1.55433	29.6416
3473.27	330	1.98246	1.56679	29.6442
3514.39	335	1.98275	1.57917	29.6468
3555.34	340	1.98304	1.59147	29.6493
3596.12	345	1.98331	1.60368	29.6518
3636.75	350	1.98358	1.61582	29.6542
3677.22	355	1.98384	1.62788	29.6565
3717.54	360	1.98409	1.63987	29.6588
3757.7	365	1.98434	1.65178	29.661
3797.71	370	1.98458	1.66362	29.6632
3837.57	375	1.98482	1.67539	29.6653
3877.28	380	1.98505	1.68709	29.6674
3916.84	385	1.98528	1.69873	29.6694
3956.25	390	1.9855	1.71029	29.6714
3995.53	395	1.98571	1.72179	29.6734
4034.66	400	1.98592	1.73323	29.6753
4073.65	405	1.98613	1.74461	29.6772
4112.5	410	1.98633	1.75592	29.679
4151.21	415	1.98653	1.76717	29.6808
4189.78	420	1.98673	1.77836	29.6826
4228.22	425	1.98692	1.7895	29.6843
4266.53	430	1.98711	1.80058	29.6861
4304.71	435	1.98729	1.8116	29.6877
4342.75	440	1.98747	1.82256	29.6894
4380.66	445	1.98765	1.83347	29.691
4418.45	450	1.98782	1.84433	29.6926
4456.11	455	1.98799	1.85514	29.6941
4493.64	460	1.98816	1.86589	29.6956
4531.05	465	1.98832	1.87659	29.6971
4568.33	470	1.98848	1.88725	29.6986
4605.49	475	1.98864	1.89785	29.7001
4642.53	480	1.9888	1.9084	29.7015
4679.45	485	1.98895	1.91891	29.7029
4716.25	490	1.9891	1.92937	29.7043
4752.94	495	1.98925	1.93978	29.7056
4789.5	500	1.9894	1.95015	29.707
4825.95	505	1.98954	1.96047	29.7083
4862.29	510	1.98968	1.97075	29.7096
4898.51	515	1.98982	1.98099	29.7109
4934.62	520	1.98996	1.99118	29.7121
4970.62	525	1.99009	2.00133	29.7134

Iteración Levenberg-Marquardt 11				
5006.51	530	1.99022	2.01144	29.7146
5042.28	535	1.99035	2.0215	29.7158
5077.95	540	1.99048	2.03153	29.717
5113.51	545	1.99061	2.04152	29.7181
5148.96	550	1.99073	2.05146	29.7193
5184.31	555	1.99086	2.06137	29.7204
5219.55	560	1.99098	2.07124	29.7215
5254.69	565	1.9911	2.08107	29.7226
5289.72	570	1.99122	2.09087	29.7237
5324.65	575	1.99133	2.10063	29.7248
5359.48	580	1.99145	2.11035	29.7259
5394.2	585	1.99156	2.12003	29.7269
5428.83	590	1.99167	2.12968	29.7279
5463.36	595	1.99178	2.1393	29.7289
5497.78	600	1.99189	2.14888	29.73
5532.12	605	1.992	2.15842	29.7309
5566.35	610	1.9921	2.16793	29.7319
5600.48	615	1.99221	2.17741	29.7329
5634.52	620	1.99231	2.18686	29.7338
5668.47	625	1.99241	2.19627	29.7348
5702.32	630	1.99251	2.20565	29.7357
5736.08	635	1.99261	2.215	29.7366
5769.74	640	1.99271	2.22432	29.7375
5803.32	645	1.99281	2.23361	29.7384
5836.8	650	1.9929	2.24286	29.7393
5870.19	655	1.993	2.25209	29.7402
5903.49	660	1.99309	2.26129	29.741
5936.7	665	1.99318	2.27045	29.7419
5969.82	670	1.99327	2.27959	29.7427
6002.85	675	1.99336	2.2887	29.7436
6035.79	680	1.99345	2.29778	29.7444
6068.65	685	1.99354	2.30683	29.7452
6101.42	690	1.99363	2.31585	29.746
6134.11	695	1.99371	2.32485	29.7468
6166.71	700	1.9938	2.33382	29.7476
6199.23	705	1.99388	2.34276	29.7484
6231.66	710	1.99397	2.35167	29.7492
6264.01	715	1.99405	2.36056	29.7499
6296.27	720	1.99413	2.36942	29.7507
6328.45	725	1.99421	2.37826	29.7514
6360.55	730	1.99429	2.38707	29.7522
6392.57	735	1.99437	2.39585	29.7529
6424.51	740	1.99445	2.40461	29.7536
6456.37	745	1.99452	2.41335	29.7543
6488.15	750	1.9946	2.42206	29.755
6519.85	755	1.99467	2.43074	29.7557

Iteración Levenberg-Marquardt 11				
6551.47	760	1.99475	2.4394	29.7564
6583.02	765	1.99482	2.44804	29.7571
6614.48	770	1.9949	2.45665	29.7578
6645.87	775	1.99497	2.46524	29.7585
6677.18	780	1.99504	2.47381	29.7591
6708.42	785	1.99511	2.48235	29.7598
6739.58	790	1.99518	2.49087	29.7604
6770.66	795	1.99525	2.49937	29.7611
6801.67	800	1.99532	2.50785	29.7617
6832.61	805	1.99539	2.5163	29.7624
6863.47	810	1.99545	2.52473	29.763
6894.26	815	1.99552	2.53314	29.7636
6924.97	820	1.99559	2.54153	29.7642
6955.62	825	1.99565	2.5499	29.7648
6986.19	830	1.99572	2.55825	29.7654
7016.69	835	1.99578	2.56657	29.766
7047.12	840	1.99585	2.57488	29.7666
7077.48	845	1.99591	2.58316	29.7672
7107.76	850	1.99597	2.59142	29.7678
7137.98	855	1.99603	2.59966	29.7684
7168.13	860	1.9961	2.60789	29.769
7198.21	865	1.99616	2.61609	29.7695
7228.22	870	1.99622	2.62427	29.7701
7258.16	875	1.99628	2.63244	29.7706
7288.04	880	1.99634	2.64058	29.7712
7317.84	885	1.9964	2.64871	29.7717
7347.58	890	1.99645	2.65681	29.7723
7377.26	895	1.99651	2.6649	29.7728
7406.86	900	1.99657	2.67297	29.7734
7436.41	905	1.99663	2.68102	29.7739
7465.88	910	1.99668	2.68905	29.7744
7495.29	915	1.99674	2.69706	29.7749
7524.64	920	1.99679	2.70506	29.7754
7553.92	925	1.99685	2.71303	29.776
7583.14	930	1.9969	2.72099	29.7765
7612.29	935	1.99696	2.72894	29.777
7641.38	940	1.99701	2.73686	29.7775
7670.41	945	1.99706	2.74477	29.778
7699.37	950	1.99712	2.75266	29.7785
7728.27	955	1.99717	2.76053	29.7789
7757.12	960	1.99722	2.76838	29.7794
7785.89	965	1.99727	2.77622	29.7799
7814.61	970	1.99732	2.78404	29.7804
7843.27	975	1.99737	2.79185	29.7809
7871.86	980	1.99742	2.79964	29.7813
7900.4	985	1.99747	2.80741	29.7818

Iteración Levenberg-Marquardt 11				
7928.87	990	1.99752	2.81517	29.7822
7957.29	995	1.99757	2.8229	29.7827
7985.64	1000	1.99762	2.83063	29.7832
8013.94	1005	1.99767	2.83834	29.7836
8042.18	1010	1.99772	2.84603	29.7841
8070.36	1015	1.99776	2.85371	29.7845
8098.48	1020	1.99781	2.86137	29.7849
8126.55	1025	1.99786	2.86901	29.7854
8154.55	1030	1.9979	2.87664	29.7858
8182.5	1035	1.99795	2.88426	29.7862
8210.39	1040	1.998	2.89186	29.7867
8238.23	1045	1.99804	2.89945	29.7871
8266.01	1050	1.99809	2.90702	29.7875
8293.73	1055	1.99813	2.91457	29.7879
8321.4	1060	1.99818	2.92211	29.7883
8349.01	1065	1.99822	2.92964	29.7887
8376.56	1070	1.99826	2.93715	29.7892
8404.07	1075	1.99831	2.94465	29.7896
8431.51	1080	1.99835	2.95213	29.79
8458.9	1085	1.99839	2.9596	29.7904
8486.24	1090	1.99844	2.96706	29.7908
8513.53	1095	1.99848	2.9745	29.7912
8540.76	1100	1.99852	2.98193	29.7915
8567.93	1105	1.99856	2.98934	29.7919
8595.06	1110	1.9986	2.99674	29.7923
8622.13	1115	1.99864	3.00413	29.7927
8649.15	1120	1.99868	3.0115	29.7931
8676.11	1125	1.99872	3.01886	29.7935
8703.03	1130	1.99876	3.02621	29.7938
8729.89	1135	1.9988	3.03354	29.7942
8756.7	1140	1.99884	3.04086	29.7946
8783.46	1145	1.99888	3.04817	29.795
8810.17	1150	1.99892	3.05547	29.7953
8836.82	1155	1.99896	3.06275	29.7957
8863.43	1160	1.999	3.07002	29.796
8889.99	1165	1.99904	3.07727	29.7964
8916.49	1170	1.99908	3.08452	29.7968
8942.95	1175	1.99911	3.09175	29.7971
8969.35	1180	1.99915	3.09897	29.7975
8995.71	1185	1.99919	3.10617	29.7978
9022.02	1190	1.99923	3.11337	29.7982
9048.28	1195	1.99926	3.12055	29.7985
9074.48	1200	1.9993	3.12772	29.7988
9100.65	1205	1.99934	3.13488	29.7992
9126.76	1210	1.99937	3.14202	29.7995
9152.82	1215	1.99941	3.14916	29.7999

Iteración Levenberg-Marquardt 11				
9178.84	1220	1.99944	3.15628	29.8002
9204.81	1225	1.99948	3.16339	29.8005
9230.73	1230	1.99952	3.17049	29.8009
9256.6	1235	1.99955	3.17757	29.8012
9282.43	1240	1.99959	3.18465	29.8015
9308.21	1245	1.99962	3.19171	29.8018
9333.94	1250	1.99965	3.19877	29.8022
9359.63	1255	1.99969	3.20581	29.8025
9385.27	1260	1.99972	3.21284	29.8028
9410.87	1265	1.99976	3.21986	29.8031
9436.42	1270	1.99979	3.22686	29.8034
9461.92	1275	1.99982	3.23386	29.8037
9487.38	1280	1.99986	3.24085	29.804
9512.79	1285	1.99989	3.24782	29.8044
9538.16	1290	1.99992	3.25478	29.8047
9563.48	1295	1.99995	3.26174	29.805
9588.76	1300	1.99999	3.26868	29.8053
9613.99	1305	2.00002	3.27561	29.8056
9639.18	1310	2.00005	3.28253	29.8059
9664.33	1315	2.00008	3.28944	29.8062
9689.43	1320	2.00011	3.29634	29.8065
9714.49	1325	2.00015	3.30323	29.8068
9739.5	1330	2.00018	3.31011	29.807
9764.47	1335	2.00021	3.31698	29.8073
9789.4	1340	2.00024	3.32384	29.8076
9814.28	1345	2.00027	3.33069	29.8079
9839.12	1350	2.0003	3.33752	29.8082
9863.92	1355	2.00033	3.34435	29.8085
9888.68	1360	2.00036	3.35117	29.8088
9913.4	1365	2.00039	3.35798	29.809
9938.07	1370	2.00042	3.36478	29.8093
9962.7	1375	2.00045	3.37157	29.8096
9987.29	1380	2.00048	3.37834	29.8099
10011.8	1385	2.00051	3.38511	29.8102
10036.3	1390	2.00054	3.39187	29.8104

Ilustración 63.- Iteración 12 de Levenberg-Marquardt para Suelo Limo.

Tabla 18. Décimo Segunda iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 12					Iteración Levenberg-Marquardt 12					Iteración Levenberg-Marquardt 12				
0	0	0	0	0	1349.26	100	1.93289	0.845876	29.2598	2340.17	200	1.97012	1.2051	29.5393
146.5	5	1.12891	0.174342	146.5	1402.34	105	1.93678	0.867035	29.2882	2386.56	205	1.97091	1.22054	29.5457
266.906	10	1.40742	0.266867	19.8659	1454.95	110	1.94026	0.887727	29.3137	2432.7	210	1.97165	1.2358	29.5518
346.701	15	1.54324	0.328542	24.623	1507.12	115	1.94341	0.907984	29.3367	2478.59	215	1.97236	1.25091	29.5576
405.682	20	1.63197	0.379248	26.1563	1558.87	120	1.94625	0.927833	29.3575	2524.25	220	1.97304	1.26585	29.5632
471.114	25	1.69497	0.423576	27.0161	1610.22	125	1.94882	0.947301	29.3765	2569.68	225	1.97368	1.28065	29.5685
537.9	30	1.7419	0.463559	27.5653	1661.17	130	1.95117	0.96641	29.3938	2614.87	230	1.97429	1.29529	29.5736
601.961	35	1.77795	0.500324	27.9454	1711.76	135	1.95331	0.98518	29.4097	2659.85	235	1.97487	1.30979	29.5785
664.139	40	1.80631	0.534574	28.2224	1761.98	140	1.95527	1.00363	29.4244	2704.6	240	1.97543	1.32415	29.5832
725.661	45	1.82907	0.566786	28.4317	1811.85	145	1.95707	1.02178	29.4379	2749.13	245	1.97596	1.33838	29.5877
786.312	50	1.84768	0.597303	28.5943	1861.38	150	1.95873	1.03964	29.4505	2793.46	250	1.97647	1.35247	29.592
845.896	55	1.86312	0.626378	28.7239	1910.59	155	1.96027	1.05723	29.4621	2837.57	255	1.97697	1.36644	29.5962
904.563	60	1.8761	0.654209	28.8292	1959.48	160	1.96169	1.07455	29.473	2881.48	260	1.97744	1.38028	29.6002
962.453	65	1.88713	0.68095	28.9164	2008.07	165	1.96301	1.09163	29.4832	2925.19	265	1.97789	1.39401	29.6041
1019.6	70	1.8966	0.706727	28.9896	2056.35	170	1.96423	1.10847	29.4927	2968.7	270	1.97833	1.40762	29.6079
1076.05	75	1.90478	0.731642	29.0518	2104.34	175	1.96538	1.12509	29.5016	3012.01	275	1.97875	1.42111	29.6115
1131.84	80	1.91191	0.755782	29.1052	2152.05	180	1.96645	1.14149	29.51	3055.13	280	1.97915	1.4345	29.6151
1187.02	85	1.91816	0.779217	29.1517	2199.48	185	1.96745	1.15768	29.5179	3098.06	285	1.97954	1.44778	29.6185
1241.63	90	1.92367	0.80201	29.1923	2246.64	190	1.96839	1.17368	29.5255	3140.8	290	1.97992	1.46096	29.6218
1295.71	95	1.92855	0.824214	29.2281	2293.54	195	1.96928	1.18948	29.5326	3183.35	295	1.98029	1.47403	29.625
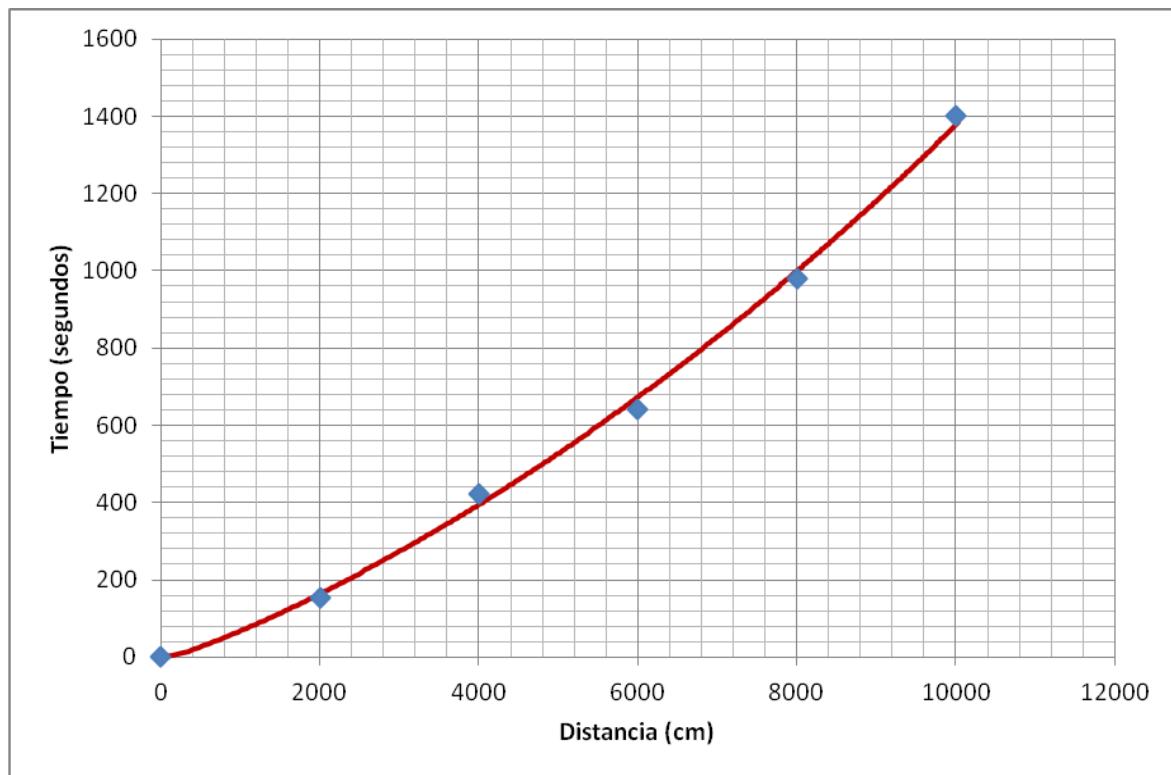
Iteración Levenberg-Marquardt 12			
3225.73	300	1.98064	1.487	29.6281
3267.92	305	1.98099	1.49988	29.6311
3309.94	310	1.98132	1.51267	29.6341
3351.79	315	1.98164	1.52536	29.6369
3393.46	320	1.98196	1.53796	29.6397
3434.96	325	1.98226	1.55048	29.6424
3476.29	330	1.98256	1.56291	29.645
3517.46	335	1.98285	1.57525	29.6476
3558.46	340	1.98313	1.58752	29.6501
3599.31	345	1.9834	1.5997	29.6526
3639.99	350	1.98367	1.61181	29.655
3680.51	355	1.98393	1.62384	29.6573
3720.88	360	1.98418	1.63579	29.6596
3761.1	365	1.98443	1.64767	29.6618
3801.16	370	1.98467	1.65948	29.664
3841.08	375	1.98491	1.67122	29.6661
3880.84	380	1.98514	1.68289	29.6682
3920.46	385	1.98536	1.6945	29.6702
3959.93	390	1.98558	1.70603	29.6722
3999.25	395	1.9858	1.7175	29.6742
4038.44	400	1.98601	1.72891	29.6761
4077.48	405	1.98622	1.74025	29.6779
4116.39	410	1.98642	1.75154	29.6798
4155.16	415	1.98662	1.76276	29.6816
4193.79	420	1.98681	1.77392	29.6833
4232.28	425	1.987	1.78503	29.6851
4270.65	430	1.98719	1.79608	29.6868
4308.88	435	1.98737	1.80707	29.6884
4346.97	440	1.98755	1.81801	29.6901
4384.94	445	1.98773	1.82889	29.6917
4422.79	450	1.9879	1.83972	29.6933
4460.5	455	1.98807	1.85049	29.6948
4498.09	460	1.98824	1.86122	29.6964
4535.55	465	1.9884	1.87189	29.6978
4572.89	470	1.98856	1.88252	29.6993
4610.11	475	1.98872	1.89309	29.7008
4647.2	480	1.98888	1.90362	29.7022
4684.18	485	1.98903	1.9141	29.7036
4721.04	490	1.98918	1.92453	29.705
4757.78	495	1.98933	1.93492	29.7063
4794.4	500	1.98948	1.94526	29.7077
4830.91	505	1.98962	1.95555	29.709
4867.3	510	1.98976	1.9658	29.7103
4903.58	515	1.9899	1.97601	29.7115
4939.74	520	1.99003	1.98618	29.7128
4975.8	525	1.99017	1.9963	29.714

Iteración Levenberg-Marquardt 12			
5011.74	530	1.9903	2.00638	29.7153
5047.57	535	1.99043	2.01642	29.7165
5083.3	540	1.99056	2.02642	29.7176
5118.91	545	1.99069	2.03638	29.7188
5154.42	550	1.99081	2.0463	29.7199
5189.83	555	1.99093	2.05618	29.7211
5225.12	560	1.99105	2.06603	29.7222
5260.32	565	1.99117	2.07583	29.7233
5295.41	570	1.99129	2.0856	29.7244
5330.39	575	1.99141	2.09533	29.7254
5365.28	580	1.99152	2.10503	29.7265
5400.06	585	1.99163	2.11468	29.7275
5434.75	590	1.99175	2.12431	29.7286
5469.33	595	1.99186	2.1339	29.7296
5503.81	600	1.99196	2.14345	29.7306
5538.2	605	1.99207	2.15297	29.7316
5572.49	610	1.99218	2.16246	29.7326
5606.68	615	1.99228	2.17191	29.7335
5640.78	620	1.99238	2.18133	29.7345
5674.78	625	1.99249	2.19072	29.7354
5708.69	630	1.99259	2.20008	29.7363
5742.51	635	1.99268	2.2094	29.7372
5776.23	640	1.99278	2.21869	29.7382
5809.86	645	1.99288	2.22796	29.739
5843.4	650	1.99297	2.23719	29.7399
5876.84	655	1.99307	2.24639	29.7408
5910.2	660	1.99316	2.25556	29.7417
5943.47	665	1.99325	2.2647	29.7425
5976.64	670	1.99334	2.27381	29.7434
6009.73	675	1.99343	2.2829	29.7442
6042.74	680	1.99352	2.29195	29.745
6075.65	685	1.99361	2.30098	29.7458
6108.48	690	1.9937	2.30998	29.7466
6141.22	695	1.99378	2.31895	29.7474
6173.88	700	1.99387	2.32789	29.7482
6206.45	705	1.99395	2.33681	29.749
6238.94	710	1.99404	2.3457	29.7498
6271.35	715	1.99412	2.35457	29.7505
6303.67	720	1.9942	2.3634	29.7513
6335.91	725	1.99428	2.37222	29.752
6368.07	730	1.99436	2.381	29.7528
6400.14	735	1.99444	2.38976	29.7535
6432.14	740	1.99451	2.3985	29.7542
6464.06	745	1.99459	2.40721	29.7549
6495.89	750	1.99467	2.41589	29.7556
6527.65	755	1.99474	2.42456	29.7563

Iteración Levenberg-Marquardt 12			
6559.33	760	1.99482	2.43319	29.757
6590.93	765	1.99489	2.44181	29.7577
6622.45	770	1.99496	2.4504	29.7584
6653.9	775	1.99504	2.45896	29.759
6685.27	780	1.99511	2.46751	29.7597
6716.56	785	1.99518	2.47603	29.7604
6747.78	790	1.99525	2.48453	29.761
6778.92	795	1.99532	2.493	29.7617
6809.98	800	1.99539	2.50145	29.7623
6840.98	805	1.99545	2.50988	29.7629
6871.9	810	1.99552	2.51829	29.7636
6902.74	815	1.99559	2.52668	29.7642
6933.52	820	1.99565	2.53505	29.7648
6964.22	825	1.99572	2.54339	29.7654
6994.84	830	1.99579	2.55171	29.766
7025.4	835	1.99585	2.56002	29.7666
7055.89	840	1.99591	2.5683	29.7672
7086.3	845	1.99598	2.57656	29.7678
7116.65	850	1.99604	2.5848	29.7684
7146.92	855	1.9961	2.59302	29.7689
7177.13	860	1.99616	2.60122	29.7695
7207.26	865	1.99622	2.6094	29.7701
7237.33	870	1.99628	2.61756	29.7706
7267.33	875	1.99634	2.6257	29.7712
7297.26	880	1.9964	2.63382	29.7718
7327.13	885	1.99646	2.64193	29.7723
7356.92	890	1.99652	2.65001	29.7728
7386.65	895	1.99658	2.65808	29.7734
7416.32	900	1.99663	2.66612	29.7739
7445.92	905	1.99669	2.67415	29.7744
7475.45	910	1.99675	2.68216	29.775
7504.92	915	1.9968	2.69015	29.7755
7534.32	920	1.99686	2.69812	29.776
7563.66	925	1.99691	2.70608	29.7765
7592.93	930	1.99697	2.71402	29.777
7622.14	935	1.99702	2.72193	29.7775
7651.29	940	1.99707	2.72984	29.778
7680.37	945	1.99713	2.73772	29.7785
7709.39	950	1.99718	2.74559	29.779
7738.35	955	1.99723	2.75344	29.7795
7767.25	960	1.99728	2.76127	29.78
7796.08	965	1.99733	2.76909	29.7804
7824.86	970	1.99739	2.77689	29.7809
7853.57	975	1.99744	2.78467	29.7814
7882.22	980	1.99749	2.79244	29.7819
7910.82	985	1.99754	2.80019	29.7823

Iteración Levenberg-Marquardt 12				
7939.35	990	1.99758	2.80793	29.7828
7967.82	995	1.99763	2.81564	29.7832
7996.23	1000	1.99768	2.82335	29.7837
8024.59	1005	1.99773	2.83103	29.7841
8052.88	1010	1.99778	2.83871	29.7846
8081.12	1015	1.99783	2.84636	29.785
8109.3	1020	1.99787	2.854	29.7855
8137.42	1025	1.99792	2.86163	29.7859
8165.48	1030	1.99797	2.86924	29.7863
8193.48	1035	1.99801	2.87683	29.7868
8221.43	1040	1.99806	2.88441	29.7872
8249.32	1045	1.9981	2.89197	29.7876
8277.16	1050	1.99815	2.89952	29.788
8304.94	1055	1.99819	2.90706	29.7884
8332.66	1060	1.99824	2.91458	29.7889
8360.33	1065	1.99828	2.92208	29.7893
8387.94	1070	1.99832	2.92958	29.7897
8415.5	1075	1.99837	2.93705	29.7901
8443	1080	1.99841	2.94452	29.7905
8470.45	1085	1.99845	2.95196	29.7909
8497.84	1090	1.9985	2.9594	29.7913
8525.18	1095	1.99854	2.96682	29.7917
8552.47	1100	1.99858	2.97423	29.7921
8579.7	1105	1.99862	2.98162	29.7925
8606.88	1110	1.99866	2.989	29.7928
8634.01	1115	1.9987	2.99637	29.7932
8661.09	1120	1.99874	3.00372	29.7936
8688.11	1125	1.99878	3.01106	29.794
8715.08	1130	1.99882	3.01839	29.7944
8741.99	1135	1.99886	3.0257	29.7947
8768.86	1140	1.9989	3.033	29.7951
8795.68	1145	1.99894	3.04029	29.7955
8822.44	1150	1.99898	3.04756	29.7958
8849.15	1155	1.99902	3.05482	29.7962
8875.82	1160	1.99906	3.06207	29.7965
8902.43	1165	1.9991	3.06931	29.7969
8928.99	1170	1.99914	3.07653	29.7973
8955.5	1175	1.99917	3.08374	29.7976
8981.96	1180	1.99921	3.09094	29.798
9008.37	1185	1.99925	3.09813	29.7983
9034.74	1190	1.99929	3.1053	29.7987
9061.05	1195	1.99932	3.11246	29.799
9087.32	1200	1.99936	3.11961	29.7993
9113.53	1205	1.9994	3.12675	29.7997
9139.7	1210	1.99943	3.13387	29.8
9165.82	1215	1.99947	3.14099	29.8004

Iteración Levenberg-Marquardt 12				
9191.89	1220	1.9995	3.14809	29.8007
9217.92	1225	1.99954	3.15518	29.801
9243.9	1230	1.99957	3.16226	29.8014
9269.82	1235	1.99961	3.16933	29.8017
9295.71	1240	1.99964	3.17638	29.802
9321.54	1245	1.99968	3.18343	29.8023
9347.33	1250	1.99971	3.19046	29.8026
9373.07	1255	1.99975	3.19748	29.803
9398.77	1260	1.99978	3.20449	29.8033
9424.42	1265	1.99981	3.21149	29.8036
9450.02	1270	1.99985	3.21848	29.8039
9475.58	1275	1.99988	3.22545	29.8042
9501.1	1280	1.99991	3.23242	29.8045
9526.56	1285	1.99995	3.23938	29.8048
9551.99	1290	1.99998	3.24632	29.8051
9577.37	1295	2.00001	3.25325	29.8055
9602.7	1300	2.00004	3.26018	29.8058
9627.99	1305	2.00008	3.26709	29.8061
9653.23	1310	2.00011	3.27399	29.8064
9678.43	1315	2.00014	3.28088	29.8067
9703.59	1320	2.00017	3.28776	29.8069
9728.7	1325	2.0002	3.29463	29.8072
9753.77	1330	2.00023	3.30149	29.8075
9778.8	1335	2.00027	3.30834	29.8078
9803.78	1340	2.0003	3.31518	29.8081
9828.72	1345	2.00033	3.32201	29.8084
9853.61	1350	2.00036	3.32883	29.8087
9878.47	1355	2.00039	3.33564	29.809
9903.28	1360	2.00042	3.34243	29.8092
9928.05	1365	2.00045	3.34922	29.8095
9952.78	1370	2.00048	3.356	29.8098
9977.46	1375	2.00051	3.36277	29.8101
10002.1	1380	2.00054	3.36953	29.8104
10026.7	1385	2.00057	3.37628	29.8106

Ilustración 64.- Iteración 13 de Levenberg-Marquardt para Suelo Limo.

Tabla 19. Décimo tercera iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 13					Iteración Levenberg-Marquardt 13					Iteración Levenberg-Marquardt 13				
0	0	0	0	0	1349.91	100	1.93302	0.844104	29.261	2341.62	200	1.97022	1.20254	29.5402
146.538	5	1.12894	0.173984	146.538	1403.02	105	1.93691	0.865217	29.2894	2388.05	205	1.97101	1.21795	29.5466
266.98	10	1.40746	0.266318	19.868	1455.67	110	1.94039	0.885865	29.3148	2434.23	210	1.97175	1.23318	29.5527
346.811	15	1.54331	0.327866	24.6245	1507.88	115	1.94353	0.906078	29.3378	2480.17	215	1.97246	1.24825	29.5585
405.816	20	1.63206	0.378466	26.1577	1559.67	120	1.94637	0.925884	29.3586	2525.87	220	1.97314	1.26317	29.564
471.271	25	1.69507	0.422701	27.0175	1611.05	125	1.94895	0.94531	29.3776	2571.34	225	1.97378	1.27792	29.5693
538.085	30	1.74202	0.462601	27.5667	1662.05	130	1.95129	0.964377	29.3949	2616.58	230	1.97439	1.29254	29.5744
602.175	35	1.77808	0.499288	27.9468	1712.67	135	1.95343	0.983107	29.4108	2661.59	235	1.97497	1.307	29.5793
664.383	40	1.80644	0.533466	28.2238	1762.93	140	1.95539	1.00152	29.4254	2706.39	240	1.97552	1.32133	29.584
725.935	45	1.82921	0.56561	28.4331	1812.84	145	1.95719	1.01962	29.4389	2750.97	245	1.97606	1.33553	29.5885
786.616	50	1.84782	0.596062	28.5957	1862.42	150	1.95885	1.03745	29.4515	2795.34	250	1.97657	1.34959	29.5928
846.233	55	1.86326	0.625076	28.7252	1911.66	155	1.96038	1.05499	29.4631	2839.5	255	1.97706	1.36353	29.597
904.932	60	1.87624	0.652848	28.8306	1960.6	160	1.9618	1.07228	29.474	2883.45	260	1.97753	1.37734	29.601
962.855	65	1.88727	0.679532	28.9177	2009.22	165	1.96312	1.08933	29.4841	2927.2	265	1.97798	1.39104	29.6049
1020.04	70	1.89674	0.705254	28.9908	2057.54	170	1.96434	1.10613	29.4936	2970.76	270	1.97841	1.40461	29.6087
1076.52	75	1.90492	0.730116	29.053	2105.58	175	1.96548	1.12271	29.5025	3014.11	275	1.97883	1.41808	29.6123
1132.34	80	1.91205	0.754203	29.1065	2153.33	180	1.96655	1.13908	29.5109	3057.28	280	1.97924	1.43144	29.6158
1187.56	85	1.9183	0.777588	29.1529	2200.8	185	1.96756	1.15523	29.5188	3100.25	285	1.97963	1.44469	29.6192
1242.21	90	1.9238	0.800333	29.1935	2248	190	1.9685	1.17119	29.5263	3143.04	290	1.98001	1.45783	29.6225
1296.32	95	1.92868	0.822489	29.2292	2294.94	195	1.96938	1.18696	29.5334	3185.64	295	1.98037	1.47088	29.6257
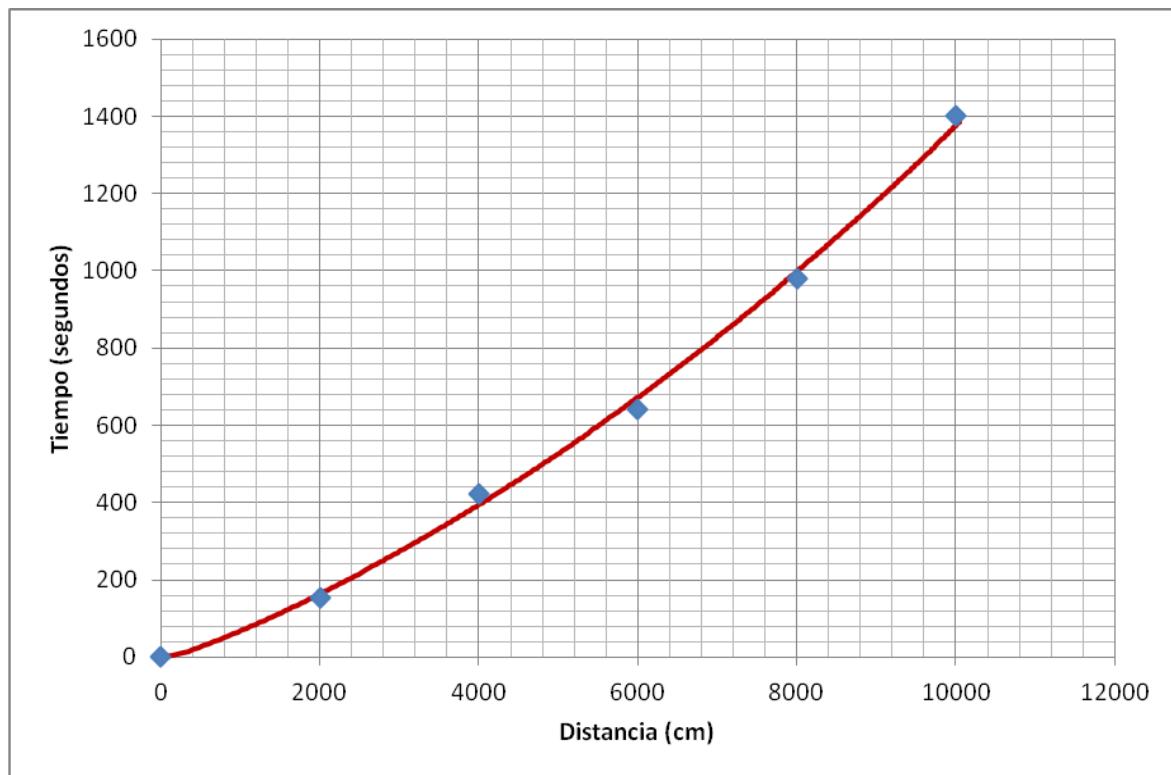
Iteración Levenberg-Marquardt 13				
3228.06	300	1.98073	1.48382	29.6288
3270.3	305	1.98107	1.49667	29.6318
3312.37	310	1.9814	1.50943	29.6348
3354.26	315	1.98173	1.52209	29.6376
3395.97	320	1.98204	1.53467	29.6404
3437.52	325	1.98234	1.54715	29.6431
3478.9	330	1.98264	1.55956	29.6457
3520.11	335	1.98293	1.57187	29.6483
3561.17	340	1.98321	1.58411	29.6508
3602.05	345	1.98348	1.59627	29.6532
3642.78	350	1.98375	1.60835	29.6556
3683.36	355	1.98401	1.62035	29.658
3723.77	360	1.98426	1.63228	29.6602
3764.03	365	1.98451	1.64413	29.6625
3804.15	370	1.98475	1.65591	29.6646
3844.11	375	1.98499	1.66763	29.6668
3883.92	380	1.98522	1.67927	29.6688
3923.58	385	1.98544	1.69085	29.6709
3963.1	390	1.98566	1.70236	29.6729
4002.47	395	1.98588	1.7138	29.6748
4041.71	400	1.98609	1.72518	29.6767
4080.8	405	1.98629	1.7365	29.6786
4119.75	410	1.9865	1.74776	29.6804
4158.57	415	1.98669	1.75896	29.6822
4197.25	420	1.98689	1.7701	29.684
4235.79	425	1.98708	1.78118	29.6857
4274.2	430	1.98726	1.7922	29.6874
4312.48	435	1.98745	1.80317	29.6891
4350.62	440	1.98763	1.81408	29.6907
4388.64	445	1.9878	1.82493	29.6923
4426.53	450	1.98797	1.83574	29.6939
4464.29	455	1.98814	1.84649	29.6954
4501.93	460	1.98831	1.85719	29.697
4539.44	465	1.98847	1.86784	29.6985
4576.83	470	1.98864	1.87844	29.6999
4614.1	475	1.98879	1.88899	29.7014
4651.24	480	1.98895	1.89949	29.7028
4688.27	485	1.9891	1.90995	29.7042
4725.17	490	1.98925	1.92036	29.7056
4761.96	495	1.9894	1.93072	29.7069
4798.63	500	1.98954	1.94104	29.7083
4835.19	505	1.98969	1.95131	29.7096
4871.63	510	1.98983	1.96154	29.7109
4907.96	515	1.98997	1.97172	29.7121
4944.17	520	1.9901	1.98186	29.7134
4980.27	525	1.99024	1.99196	29.7146

Iteración Levenberg-Marquardt 13				
5016.26	530	1.99037	2.00202	29.7158
5052.15	535	1.9905	2.01204	29.717
5087.92	540	1.99063	2.02201	29.7182
5123.58	545	1.99075	2.03195	29.7194
5159.14	550	1.99088	2.04185	29.7205
5194.59	555	1.991	2.05171	29.7216
5229.94	560	1.99112	2.06153	29.7228
5265.18	565	1.99124	2.07131	29.7239
5300.32	570	1.99136	2.08106	29.7249
5335.36	575	1.99147	2.09076	29.726
5370.29	580	1.99159	2.10044	29.7271
5405.12	585	1.9917	2.11007	29.7281
5439.86	590	1.99181	2.11967	29.7291
5474.49	595	1.99192	2.12924	29.7301
5509.02	600	1.99203	2.13877	29.7311
5543.46	605	1.99214	2.14827	29.7321
5577.8	610	1.99224	2.15774	29.7331
5612.04	615	1.99234	2.16717	29.7341
5646.19	620	1.99245	2.17657	29.735
5680.24	625	1.99255	2.18593	29.7359
5714.2	630	1.99265	2.19527	29.7369
5748.06	635	1.99275	2.20457	29.7378
5781.83	640	1.99285	2.21384	29.7387
5815.51	645	1.99294	2.22308	29.7396
5849.1	650	1.99304	2.23229	29.7405
5882.59	655	1.99313	2.24147	29.7413
5916	660	1.99322	2.25062	29.7422
5949.32	665	1.99332	2.25974	29.743
5982.54	670	1.99341	2.26883	29.7439
6015.68	675	1.9935	2.2779	29.7447
6048.73	680	1.99358	2.28693	29.7455
6081.7	685	1.99367	2.29594	29.7463
6114.58	690	1.99376	2.30491	29.7472
6147.37	695	1.99384	2.31386	29.7479
6180.08	700	1.99393	2.32279	29.7487
6212.7	705	1.99401	2.33168	29.7495
6245.24	710	1.9941	2.34055	29.7503
6277.69	715	1.99418	2.3494	29.751
6310.06	720	1.99426	2.35821	29.7518
6342.35	725	1.99434	2.367	29.7525
6374.56	730	1.99442	2.37577	29.7533
6406.69	735	1.9945	2.38451	29.754
6438.73	740	1.99457	2.39322	29.7547
6470.7	745	1.99465	2.40192	29.7554
6502.58	750	1.99473	2.41058	29.7561
6534.39	755	1.9948	2.41922	29.7568

Iteración Levenberg-Marquardt 13				
6566.12	760	1.99488	2.42784	29.7575
6597.77	765	1.99495	2.43643	29.7582
6629.34	770	1.99502	2.445	29.7589
6660.83	775	1.99509	2.45355	29.7595
6692.25	780	1.99517	2.46207	29.7602
6723.59	785	1.99524	2.47057	29.7609
6754.86	790	1.99531	2.47905	29.7615
6786.05	795	1.99538	2.48751	29.7622
6817.17	800	1.99544	2.49594	29.7628
6848.21	805	1.99551	2.50435	29.7634
6879.18	810	1.99558	2.51274	29.7641
6910.07	815	1.99565	2.52111	29.7647
6940.9	820	1.99571	2.52945	29.7653
6971.65	825	1.99578	2.53778	29.7659
7002.32	830	1.99584	2.54608	29.7665
7032.93	835	1.99591	2.55436	29.7671
7063.46	840	1.99597	2.56262	29.7677
7093.93	845	1.99603	2.57087	29.7683
7124.32	850	1.9961	2.57909	29.7689
7154.65	855	1.99616	2.58729	29.7694
7184.9	860	1.99622	2.59547	29.77
7215.09	865	1.99628	2.60363	29.7706
7245.2	870	1.99634	2.61177	29.7711
7275.25	875	1.9964	2.61989	29.7717
7305.23	880	1.99646	2.628	29.7722
7335.15	885	1.99652	2.63608	29.7728
7364.99	890	1.99657	2.64414	29.7733
7394.77	895	1.99663	2.65219	29.7739
7424.49	900	1.99669	2.66022	29.7744
7454.13	905	1.99675	2.66823	29.7749
7483.72	910	1.9968	2.67622	29.7754
7513.23	915	1.99686	2.68419	29.776
7542.68	920	1.99691	2.69214	29.7765
7572.07	925	1.99697	2.70008	29.777
7601.39	930	1.99702	2.708	29.7775
7630.65	935	1.99708	2.7159	29.778
7659.85	940	1.99713	2.72378	29.7785
7688.98	945	1.99718	2.73165	29.779
7718.05	950	1.99723	2.7395	29.7795
7747.06	955	1.99729	2.74733	29.7799
7776.01	960	1.99734	2.75514	29.7804
7804.89	965	1.99739	2.76294	29.7809
7833.71	970	1.99744	2.77072	29.7814
7862.48	975	1.99749	2.77849	29.7819
7891.18	980	1.99754	2.78624	29.7823
7919.82	985	1.99759	2.79397	29.7828

México, 2015

"Diseño y aplicación de riego por gravedad"

SEMARNAT
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Iteración Levenberg-Marquardt 13				
7948.4	990	1.99764	2.80168	29.7832
7976.92	995	1.99769	2.80938	29.7837
8005.38	1000	1.99774	2.81707	29.7841
8033.78	1005	1.99778	2.82474	29.7846
8062.13	1010	1.99783	2.83239	29.785
8090.41	1015	1.99788	2.84003	29.7855
8118.64	1020	1.99793	2.84765	29.7859
8146.81	1025	1.99797	2.85525	29.7864
8174.92	1030	1.99802	2.86285	29.7868
8202.98	1035	1.99806	2.87042	29.7872
8230.97	1040	1.99811	2.87798	29.7876
8258.91	1045	1.99816	2.88553	29.7881
8286.8	1050	1.9982	2.89306	29.7885
8314.63	1055	1.99825	2.90058	29.7889
8342.4	1060	1.99829	2.90808	29.7893
8370.11	1065	1.99833	2.91557	29.7897
8397.77	1070	1.99838	2.92304	29.7901
8425.38	1075	1.99842	2.9305	29.7905
8452.93	1080	1.99846	2.93795	29.7909
8480.43	1085	1.99851	2.94538	29.7913
8507.87	1090	1.99855	2.95279	29.7917
8535.26	1095	1.99859	2.9602	29.7921
8562.6	1100	1.99863	2.96759	29.7925
8589.88	1105	1.99867	2.97496	29.7929
8617.11	1110	1.99871	2.98232	29.7933
8644.28	1115	1.99876	2.98967	29.7937
8671.4	1120	1.9988	2.99701	29.794
8698.47	1125	1.99884	3.00433	29.7944
8725.49	1130	1.99888	3.01164	29.7948
8752.46	1135	1.99892	3.01893	29.7952
8779.37	1140	1.99896	3.02622	29.7955
8806.24	1145	1.99899	3.03349	29.7959
8833.05	1150	1.99903	3.04074	29.7963
8859.81	1155	1.99907	3.04799	29.7966
8886.52	1160	1.99911	3.05522	29.797
8913.18	1165	1.99915	3.06244	29.7973
8939.79	1170	1.99919	3.06964	29.7977
8966.35	1175	1.99922	3.07684	29.7981
8992.86	1180	1.99926	3.08402	29.7984
9019.32	1185	1.9993	3.09119	29.7987
9045.73	1190	1.99934	3.09834	29.7991
9072.09	1195	1.99937	3.10549	29.7994
9098.41	1200	1.99941	3.11262	29.7998
9124.67	1205	1.99945	3.11974	29.8001
9150.89	1210	1.99948	3.12685	29.8005
9177.06	1215	1.99952	3.13394	29.8008

Iteración Levenberg-Marquardt 13				
9203.18	1220	1.99955	3.14103	29.8011
9229.25	1225	1.99959	3.1481	29.8015
9255.28	1230	1.99962	3.15516	29.8018
9281.25	1235	1.99966	3.16221	29.8021
9307.18	1240	1.99969	3.16925	29.8024
9333.07	1245	1.99973	3.17628	29.8028
9358.9	1250	1.99976	3.1833	29.8031
9384.69	1255	1.9998	3.1903	29.8034
9410.44	1260	1.99983	3.19729	29.8037
9436.14	1265	1.99986	3.20428	29.804
9461.79	1270	1.9999	3.21125	29.8043
9487.39	1275	1.99993	3.21821	29.8046
9512.96	1280	1.99996	3.22516	29.805
9538.47	1285	2	3.23209	29.8053
9563.94	1290	2.00003	3.23902	29.8056
9589.37	1295	2.00006	3.24594	29.8059
9614.75	1300	2.00009	3.25284	29.8062
9640.08	1305	2.00013	3.25974	29.8065
9665.38	1310	2.00016	3.26662	29.8068
9690.62	1315	2.00019	3.2735	29.8071
9715.83	1320	2.00022	3.28036	29.8074
9740.99	1325	2.00025	3.28721	29.8077
9766.11	1330	2.00028	3.29406	29.808
9791.18	1335	2.00031	3.30089	29.8082
9816.21	1340	2.00035	3.30771	29.8085
9841.2	1345	2.00038	3.31452	29.8088
9866.14	1350	2.00041	3.32133	29.8091
9891.04	1355	2.00044	3.32812	29.8094
9915.9	1360	2.00047	3.3349	29.8097
9940.72	1365	2.0005	3.34167	29.8099
9965.49	1370	2.00053	3.34844	29.8102
9990.22	1375	2.00056	3.35519	29.8105
10014.9	1380	2.00059	3.36193	29.8108
10039.6	1385	2.00061	3.36866	29.811

Ilustración 65.- Iteración 14 de Levenberg-Marquardt para Suelo Limo.

Tabla 20. Décimo cuarta iteración Levenberg-Marquardt para suelo limo

Iteración Levenberg-Marquardt 14				
0	0	0	0	0
146.563	5	1.12896	0.173738	146.563
267.031	10	1.40749	0.265942	19.8694
346.886	15	1.54336	0.327402	24.6255
405.908	20	1.63212	0.37793	26.1586
471.378	25	1.69515	0.422101	27.0185
538.211	30	1.7421	0.461943	27.5676
602.322	35	1.77817	0.498577	27.9478
664.55	40	1.80654	0.532706	28.2248
726.122	45	1.82931	0.564803	28.434
786.825	50	1.84791	0.595211	28.5967
846.464	55	1.86336	0.624183	28.7262
905.185	60	1.87634	0.651914	28.8315
963.131	65	1.88737	0.678559	28.9186
1020.34	70	1.89683	0.704243	28.9917
1076.84	75	1.90502	0.729069	29.0539
1132.69	80	1.91214	0.753121	29.1073
1187.93	85	1.91839	0.776471	29.1537
1242.6	90	1.9239	0.799182	29.1943
1296.74	95	1.92877	0.821306	29.23

Iteración Levenberg-Marquardt 14				
1350.36	100	1.93311	0.842889	29.2618
1403.49	105	1.937	0.863971	29.2901
1456.17	110	1.94048	0.884587	29.3156
1508.4	115	1.94362	0.90477	29.3385
1560.22	120	1.94646	0.924548	29.3593
1611.63	125	1.94903	0.943944	29.3783
1662.65	130	1.95137	0.962983	29.3956
1713.3	135	1.95351	0.981685	29.4115
1763.58	140	1.95547	1.00007	29.4261
1813.52	145	1.95727	1.01815	29.4396
1863.12	150	1.95893	1.03594	29.4521
1912.4	155	1.96046	1.05347	29.4638
1961.36	160	1.96188	1.07073	29.4746
2010.01	165	1.96319	1.08774	29.4847
2058.36	170	1.96442	1.10453	29.4942
2106.43	175	1.96556	1.12108	29.5032
2154.2	180	1.96663	1.13742	29.5115
2201.7	185	1.96763	1.15355	29.5195
2248.94	190	1.96857	1.16949	29.5269
2295.9	195	1.96945	1.18523	29.534

Iteración Levenberg-Marquardt 14				
2342.61	200	1.97029	1.20079	29.5408
2389.07	205	1.97108	1.21617	29.5472
2435.28	210	1.97182	1.23138	29.5532
2481.25	215	1.97253	1.24643	29.559
2526.98	220	1.9732	1.26132	29.5646
2572.48	225	1.97384	1.27606	29.5699
2617.75	230	1.97445	1.29065	29.575
2662.79	235	1.97503	1.30509	29.5798
2707.62	240	1.97559	1.3194	29.5845
2752.23	245	1.97612	1.33357	29.589
2796.63	250	1.97663	1.34761	29.5934
2840.82	255	1.97712	1.36153	29.5975
2884.8	260	1.97759	1.37532	29.6015
2928.59	265	1.97804	1.389	29.6054
2972.17	270	1.97848	1.40255	29.6092
3015.56	275	1.97889	1.416	29.6128
3058.75	280	1.9793	1.42934	29.6163
3101.76	285	1.97969	1.44257	29.6197
3144.57	290	1.98007	1.45569	29.623
3187.21	295	1.98043	1.46872	29.6262

Iteración Levenberg-Marquardt 14				
3229.66	300	1.98079	1.48164	29.6293
3271.93	305	1.98113	1.49447	29.6323
3314.03	310	1.98146	1.50721	29.6353
3355.95	315	1.98178	1.51985	29.6381
3397.7	320	1.9821	1.53241	29.6409
3439.28	325	1.9824	1.54487	29.6436
3480.69	330	1.9827	1.55726	29.6462
3521.94	335	1.98298	1.56956	29.6488
3563.02	340	1.98326	1.58177	29.6513
3603.94	345	1.98354	1.59391	29.6537
3644.7	350	1.9838	1.60597	29.6561
3685.31	355	1.98406	1.61796	29.6584
3725.76	360	1.98431	1.62987	29.6607
3766.05	365	1.98456	1.6417	29.6629
3806.19	370	1.9848	1.65347	29.6651
3846.19	375	1.98504	1.66516	29.6672
3886.03	380	1.98527	1.67679	29.6693
3925.73	385	1.98549	1.68834	29.6713
3965.28	390	1.98571	1.69984	29.6733
4004.68	395	1.98593	1.71126	29.6752
4043.95	400	1.98614	1.72263	29.6772
4083.07	405	1.98634	1.73393	29.679
4122.06	410	1.98655	1.74517	29.6809
4160.91	415	1.98674	1.75635	29.6826
4199.62	420	1.98694	1.76747	29.6844
4238.2	425	1.98713	1.77853	29.6861
4276.64	430	1.98731	1.78954	29.6878
4314.95	435	1.9875	1.80049	29.6895
4353.13	440	1.98768	1.81138	29.6911
4391.18	445	1.98785	1.82222	29.6927
4429.1	450	1.98802	1.83301	29.6943
4466.9	455	1.98819	1.84375	29.6959
4504.57	460	1.98836	1.85443	29.6974
4542.11	465	1.98852	1.86506	29.6989
4579.54	470	1.98868	1.87564	29.7003
4616.83	475	1.98884	1.88618	29.7018
4654.01	480	1.989	1.89667	29.7032
4691.07	485	1.98915	1.9071	29.7046
4728.01	490	1.9893	1.9175	29.706
4764.83	495	1.98945	1.92784	29.7073
4801.54	500	1.98959	1.93814	29.7087
4838.13	505	1.98973	1.9484	29.71
4874.6	510	1.98987	1.95861	29.7113
4910.96	515	1.99001	1.96878	29.7125
4947.21	520	1.99015	1.9789	29.7138
4983.34	525	1.99028	1.98899	29.715

Iteración Levenberg-Marquardt 14				
5019.37	530	1.99041	1.99903	29.7162
5055.29	535	1.99054	2.00903	29.7174
5091.09	540	1.99067	2.01899	29.7186
5126.79	545	1.9908	2.02891	29.7198
5162.38	550	1.99092	2.03879	29.7209
5197.87	555	1.99105	2.04864	29.722
5233.25	560	1.99117	2.05844	29.7231
5268.52	565	1.99128	2.06821	29.7242
5303.7	570	1.9914	2.07794	29.7253
5338.77	575	1.99152	2.08763	29.7264
5373.73	580	1.99163	2.09729	29.7274
5408.6	585	1.99174	2.10691	29.7285
5443.37	590	1.99186	2.1165	29.7295
5478.03	595	1.99196	2.12605	29.7305
5512.6	600	1.99207	2.13557	29.7315
5547.07	605	1.99218	2.14505	29.7325
5581.44	610	1.99228	2.1545	29.7335
5615.72	615	1.99239	2.16391	29.7344
5649.9	620	1.99249	2.1733	29.7354
5683.99	625	1.99259	2.18265	29.7363
5717.98	630	1.99269	2.19197	29.7372
5751.88	635	1.99279	2.20126	29.7382
5785.68	640	1.99289	2.21051	29.7391
5819.39	645	1.99298	2.21974	29.7399
5853.01	650	1.99308	2.22893	29.7408
5886.54	655	1.99317	2.2381	29.7417
5919.98	660	1.99327	2.24723	29.7426
5953.33	665	1.99336	2.25634	29.7434
5986.6	670	1.99345	2.26542	29.7442
6019.77	675	1.99354	2.27447	29.7451
6052.85	680	1.99363	2.28348	29.7459
6085.85	685	1.99371	2.29248	29.7467
6118.76	690	1.9938	2.30144	29.7475
6151.59	695	1.99389	2.31038	29.7483
6184.33	700	1.99397	2.31928	29.7491
6216.99	705	1.99405	2.32817	29.7499
6249.56	710	1.99414	2.33702	29.7506
6282.05	715	1.99422	2.34585	29.7514
6314.45	720	1.9943	2.35465	29.7521
6346.78	725	1.99438	2.36343	29.7529
6379.02	730	1.99446	2.37218	29.7536
6411.18	735	1.99454	2.38091	29.7543
6443.26	740	1.99461	2.38961	29.7551
6475.26	745	1.99469	2.39829	29.7558
6507.18	750	1.99477	2.40694	29.7565
6539.02	755	1.99484	2.41556	29.7572
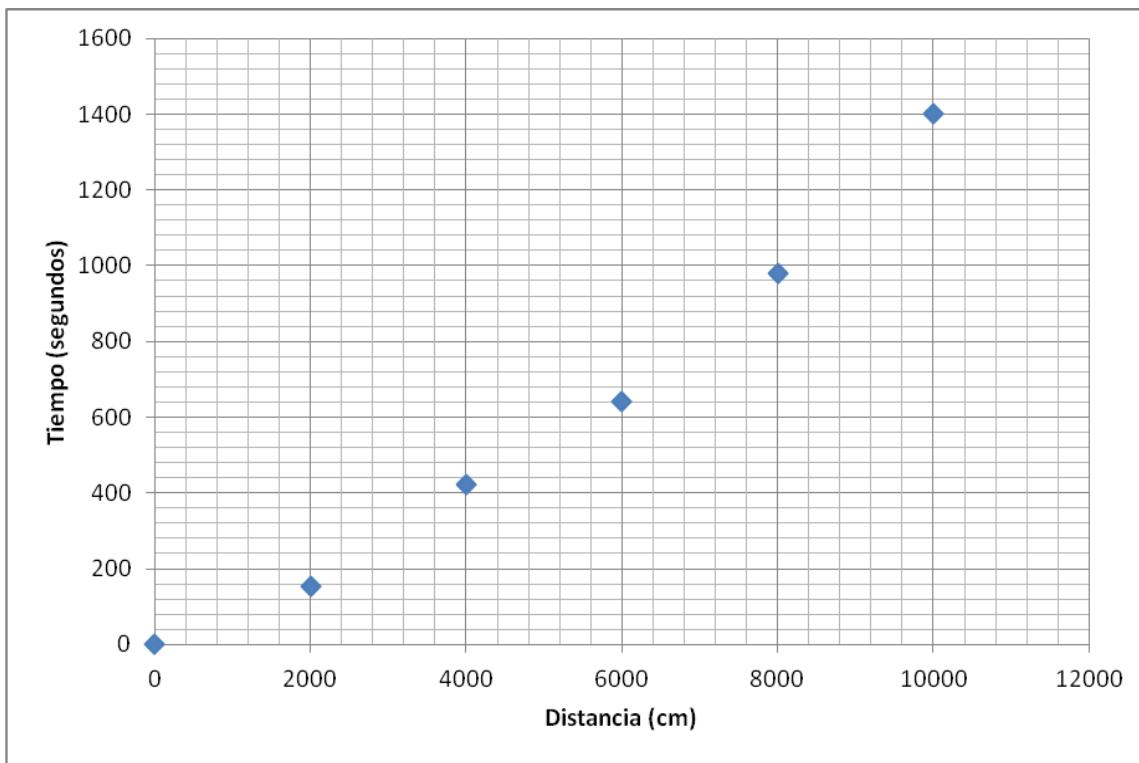
Iteración Levenberg-Marquardt 14				
6570.78	760	1.99492	2.42417	29.7579
6602.46	765	1.99499	2.43275	29.7585
6634.07	770	1.99506	2.4413	29.7592
6665.6	775	1.99513	2.44984	29.7599
6697.05	780	1.99521	2.45835	29.7606
6728.43	785	1.99528	2.46683	29.7612
6759.73	790	1.99535	2.4753	29.7619
6790.95	795	1.99542	2.48374	29.7625
6822.1	800	1.99548	2.49216	29.7631
6853.18	805	1.99555	2.50055	29.7638
6884.18	810	1.99562	2.50893	29.7644
6915.11	815	1.99569	2.51728	29.765
6945.97	820	1.99575	2.52562	29.7656
6976.75	825	1.99582	2.53393	29.7662
7007.46	830	1.99588	2.54222	29.7668
7038.1	835	1.99595	2.55049	29.7674
7068.67	840	1.99601	2.55873	29.768
7099.17	845	1.99607	2.56696	29.7686
7129.6	850	1.99613	2.57517	29.7692
7159.95	855	1.9962	2.58336	29.7698
7190.24	860	1.99626	2.59153	29.7703
7220.46	865	1.99632	2.59967	29.7709
7250.61	870	1.99638	2.6078	29.7715
7280.69	875	1.99644	2.61591	29.772
7310.71	880	1.9965	2.624	29.7726
7340.66	885	1.99656	2.63207	29.7731
7370.54	890	1.99661	2.64012	29.7736
7400.35	895	1.99667	2.64815	29.7742
7430.1	900	1.99673	2.65617	29.7747
7459.78	905	1.99678	2.66416	29.7752
7489.39	910	1.99684	2.67214	29.7758
7518.94	915	1.9969	2.6801	29.7763
7548.43	920	1.99695	2.68804	29.7768
7577.85	925	1.99701	2.69596	29.7773
7607.21	930	1.99706	2.70387	29.7778
7636.5	935	1.99711	2.71176	29.7783
7665.73	940	1.99717	2.71963	29.7788
7694.9	945	1.99722	2.72748	29.7793
7724	950	1.99727	2.73532	29.7798
7753.04	955	1.99732	2.74314	29.7803
7782.02	960	1.99738	2.75094	29.7807
7810.94	965	1.99743	2.75872	29.7812
7839.8	970	1.99748	2.76649	29.7817
7868.59	975	1.99753	2.77424	29.7822
7897.33	980	1.99758	2.78198	29.7826
7926	985	1.99763	2.7897	29.7831

Iteración Levenberg-Marquardt 14				
7954.62	990	1.99768	2.7974	29.7836
7983.17	995	1.99772	2.80509	29.784
8011.67	1000	1.99777	2.81276	29.7845
8040.1	1005	1.99782	2.82042	29.7849
8068.48	1010	1.99787	2.82806	29.7854
8096.8	1015	1.99792	2.83568	29.7858
8125.06	1020	1.99796	2.84329	29.7862
8153.26	1025	1.99801	2.85089	29.7867
8181.41	1030	1.99806	2.85847	29.7871
8209.5	1035	1.9981	2.86603	29.7875
8237.53	1040	1.99815	2.87358	29.7879
8265.5	1045	1.99819	2.88111	29.7884
8293.42	1050	1.99824	2.88863	29.7888
8321.28	1055	1.99828	2.89613	29.7892
8349.08	1060	1.99833	2.90362	29.7896
8376.83	1065	1.99837	2.9111	29.79
8404.53	1070	1.99841	2.91856	29.7904
8432.17	1075	1.99846	2.92601	29.7908
8459.75	1080	1.9985	2.93344	29.7912
8487.28	1085	1.99854	2.94086	29.7916
8514.76	1090	1.99858	2.94826	29.792
8542.18	1095	1.99863	2.95566	29.7924
8569.55	1100	1.99867	2.96303	29.7928
8596.87	1105	1.99871	2.9704	29.7932
8624.13	1110	1.99875	2.97775	29.7936
8651.34	1115	1.99879	2.98508	29.794
8678.49	1120	1.99883	2.99241	29.7943
8705.6	1125	1.99887	2.99972	29.7947
8732.65	1130	1.99891	3.00701	29.7951
8759.65	1135	1.99895	3.0143	29.7955
8786.59	1140	1.99899	3.02157	29.7958
8813.49	1145	1.99903	3.02882	29.7962
8840.34	1150	1.99907	3.03607	29.7966
8867.13	1155	1.99911	3.0433	29.7969
8893.87	1160	1.99915	3.05052	29.7973
8920.57	1165	1.99918	3.05773	29.7976
8947.21	1170	1.99922	3.06492	29.798
8973.8	1175	1.99926	3.0721	29.7983
9000.35	1180	1.9993	3.07927	29.7987
9026.84	1185	1.99933	3.08643	29.799
9053.29	1190	1.99937	3.09357	29.7994
9079.68	1195	1.99941	3.1007	29.7997
9106.03	1200	1.99944	3.10783	29.8001
9132.33	1205	1.99948	3.11493	29.8004
9158.57	1210	1.99952	3.12203	29.8008
9184.78	1215	1.99955	3.12912	29.8011
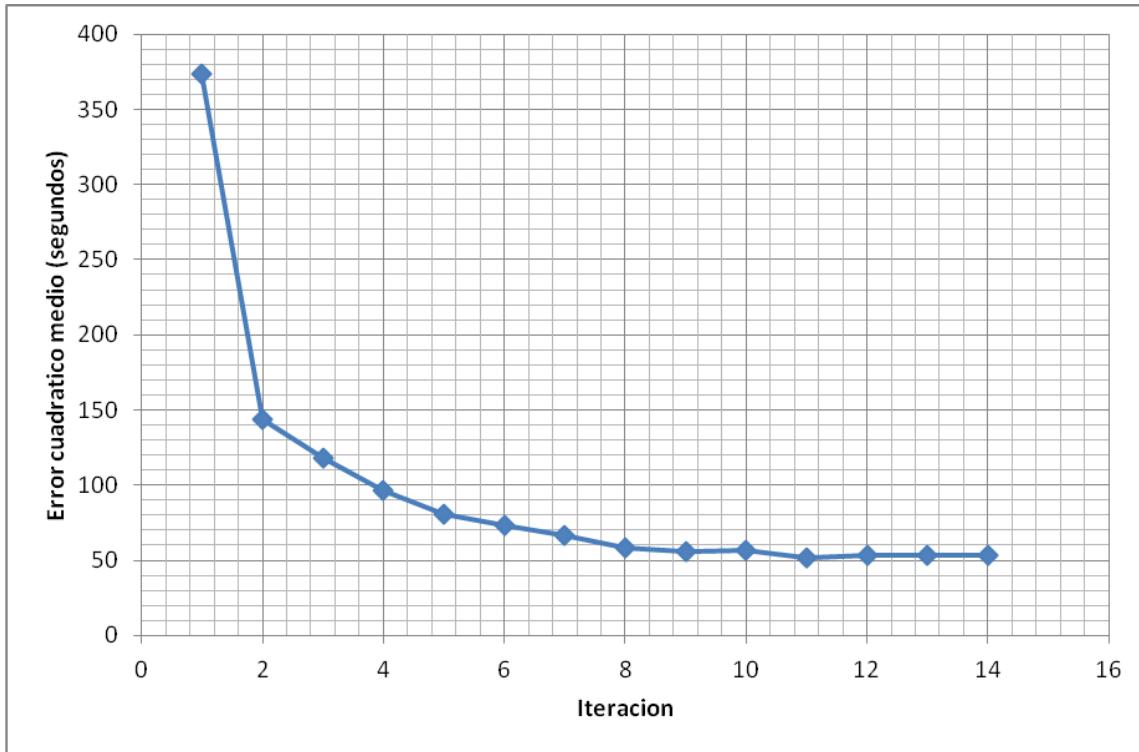
Iteración Levenberg-Marquardt 14				
9210.93	1220	1.99959	3.13619	29.8014
9237.03	1225	1.99962	3.14325	29.8017
9263.09	1230	1.99966	3.1503	29.8021
9289.1	1235	1.99969	3.15734	29.8024
9315.07	1240	1.99973	3.16436	29.8027
9340.98	1245	1.99976	3.17138	29.803
9366.85	1250	1.9998	3.17838	29.8034
9392.68	1255	1.99983	3.18538	29.8037
9418.45	1260	1.99986	3.19236	29.804
9444.18	1265	1.9999	3.19933	29.8043
9469.87	1270	1.99993	3.20629	29.8046
9495.51	1275	1.99996	3.21324	29.8049
9521.1	1280	2	3.22017	29.8052
9546.65	1285	2.00003	3.2271	29.8056
9572.15	1290	2.00006	3.23402	29.8059
9597.61	1295	2.0001	3.24092	29.8062
9623.03	1300	2.00013	3.24781	29.8065
9648.4	1305	2.00016	3.2547	29.8068
9673.72	1310	2.00019	3.26157	29.8071
9699	1315	2.00022	3.26843	29.8074
9724.24	1320	2.00025	3.27529	29.8077
9749.43	1325	2.00029	3.28213	29.8079
9774.58	1330	2.00032	3.28896	29.8082
9799.69	1335	2.00035	3.29578	29.8085
9824.75	1340	2.00038	3.30259	29.8088
9849.77	1345	2.00041	3.30939	29.8091
9874.74	1350	2.00044	3.31618	29.8094
9899.68	1355	2.00047	3.32296	29.8097
9924.57	1360	2.0005	3.32974	29.8099
9949.42	1365	2.00053	3.3365	29.8102
9974.23	1370	2.00056	3.34325	29.8105
9998.99	1375	2.00059	3.34999	29.8108
10023.7	1380	2.00062	3.35672	29.8111
10048.4	1385	2.00065	3.36344	29.8113

Observados	
0	0
2000	152
4000	421
6000	640
8000	980
10000	1400

ECM			
iteración	ECM	Ks	hf
1	373.892	1.58991	40.4081
2	143.475	1.53805	40.4066
3	117.877	1.49765	40.4055
4	96.0729	1.46685	40.4047
5	80.4984	1.44228	40.4041
6	73.0068	1.42177	40.4036
7	66.4455	1.40607	40.4032
8	58.6089	1.39411	40.4029
9	55.9911	1.38403	40.4026
10	56.6569	1.37489	40.4024
11	51.817	1.36843	40.4022
12	53.479	1.36288	40.4021
13	53.5724	1.35907	40.402
14	53.5724	1.35527	40.4019

Ilustración 66.- Tiempo y distancia observados para suelo limo.

Ilustración 67.- Error cuadrático medio (Limo).

Suelo Franco Arenoso
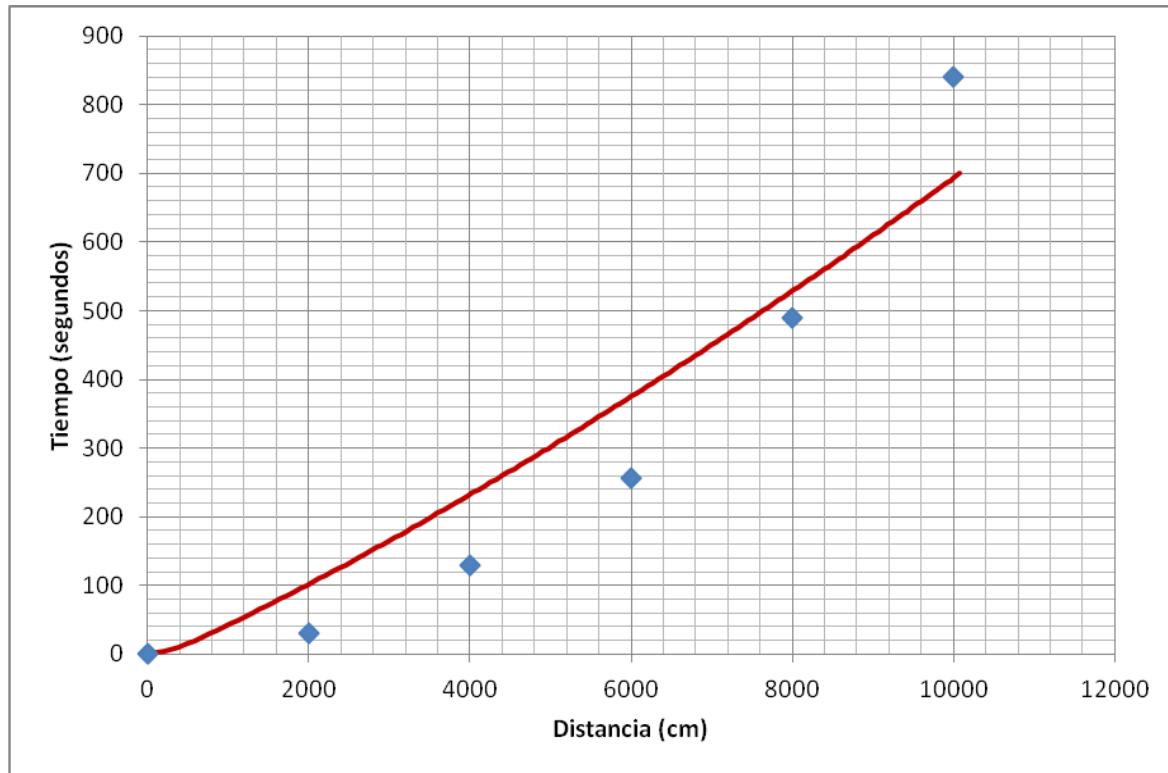
Ilustración 68.- Iteración 1 de Levenberg-Marquardt para Suelo Franco Arenoso.

Tabla 21. Primera iteración Levenberg-Marquardt para suelo franco arenoso.
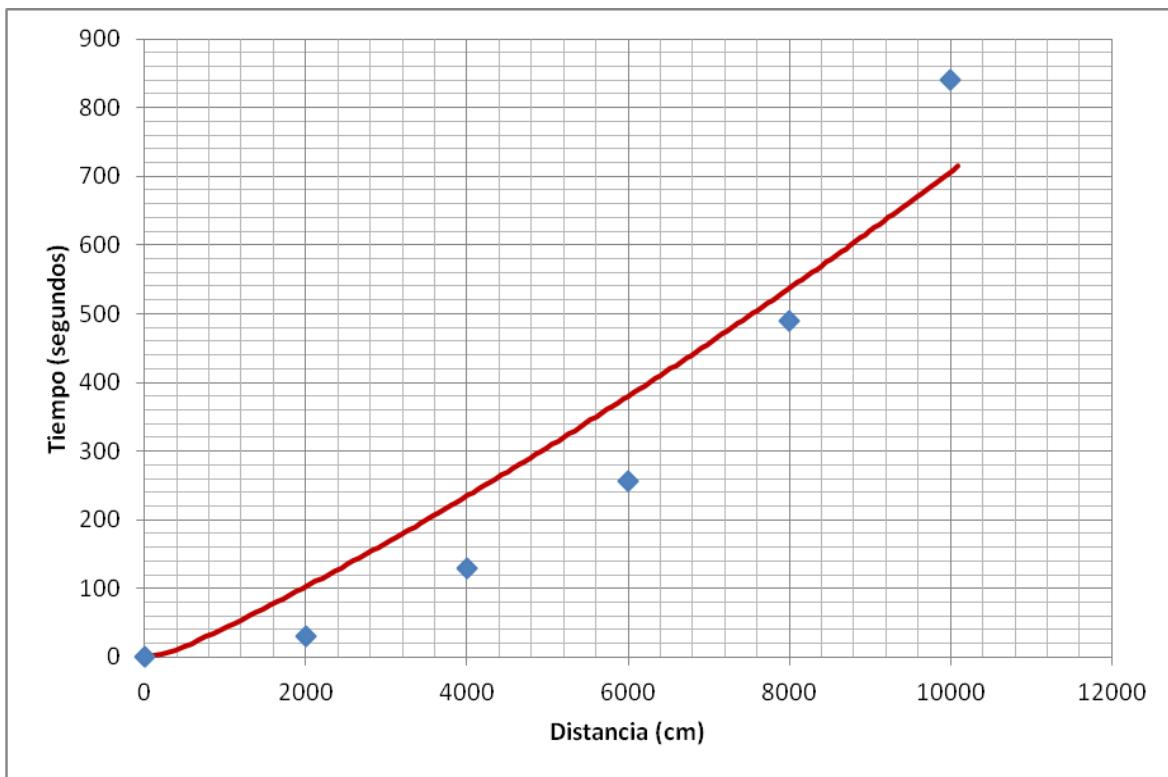
Iteración Levenberg-Marquardt 1				
0	0	0	0	0
203.497	5	1.31491	0.0920082	203.497
380.128	10	1.61913	0.153028	30.8255
497.79	15	1.77143	0.192091	37.575
583.964	20	1.87336	0.224328	39.7685
674.859	25	1.9478	0.252652	41.0006
768.834	30	2.00483	0.278319	41.7926
860.979	35	2.04974	0.302015	42.3451
951.018	40	2.0857	0.324169	42.7518
1040.22	45	2.11482	0.34507	43.0623
1128.69	50	2.13861	0.364924	43.3052
1216.22	55	2.1582	0.383887	43.4988
1302.85	60	2.17443	0.402077	43.6553
1388.7	65	2.18797	0.419589	43.7833
1473.84	70	2.19934	0.436499	43.8891
1558.29	75	2.20894	0.452871	43.9773
1642.11	80	2.21711	0.468758	44.0516

Iteración Levenberg-Marquardt 1				
1725.33	85	2.22409	0.484204	44.1146
1807.99	90	2.23009	0.499247	44.1684
1890.12	95	2.23527	0.513921	44.2148
1971.74	100	2.23978	0.528254	44.255
2052.88	105	2.24372	0.542272	44.2901
2133.57	110	2.24718	0.555997	44.3209
2213.82	115	2.25022	0.569449	44.3481
2293.65	120	2.25292	0.582645	44.3722
2373.09	125	2.25532	0.595601	44.3938
2452.13	130	2.25746	0.608332	44.4131
2530.81	135	2.25938	0.620851	44.4305
2609.12	140	2.26111	0.633169	44.4463
2687.09	145	2.26267	0.645297	44.4606
2764.73	150	2.26408	0.657245	44.4737
2842.03	155	2.26537	0.669022	44.4857
2919.02	160	2.26654	0.680636	44.4967
2995.7	165	2.26762	0.692095	44.5068

Iteración Levenberg-Marquardt 1				
3072.08	170	2.26861	0.703406	44.5163
3148.16	175	2.26952	0.714576	44.525
3223.96	180	2.27036	0.72561	44.5331
3299.48	185	2.27115	0.736515	44.5407
3374.72	190	2.27188	0.747295	44.5479
3449.69	195	2.27256	0.757955	44.5546
3524.4	200	2.27319	0.768501	44.5609
3598.85	205	2.27379	0.778935	44.5668
3673.05	210	2.27435	0.789264	44.5725
3747	215	2.27488	0.79949	44.5778
3820.7	220	2.27538	0.809616	44.5829
3894.17	225	2.27585	0.819647	44.5877
3967.39	230	2.2763	0.829586	44.5923
4040.38	235	2.27672	0.839435	44.5968
4113.14	240	2.27713	0.849197	44.601
4185.68	245	2.27752	0.858876	44.605
4257.99	250	2.27789	0.868474	44.6089

Iteración Levenberg-Marquardt 1				
4330.08	255	2.27824	0.877992	44.6126
4401.95	260	2.27858	0.887435	44.6162
4473.61	265	2.27891	0.896803	44.6196
4545.06	270	2.27922	0.906098	44.623
4616.3	275	2.27953	0.915324	44.6262
4687.33	280	2.27982	0.924482	44.6293
4758.15	285	2.2801	0.933573	44.6323
4828.78	290	2.28037	0.9426	44.6352
4899.21	295	2.28063	0.951564	44.638
4969.43	300	2.28089	0.960466	44.6408
5039.47	305	2.28113	0.969309	44.6434
5109.31	310	2.28137	0.978094	44.646
5178.96	315	2.2816	0.986821	44.6485
5248.42	320	2.28183	0.995494	44.6509
5317.69	325	2.28204	1.00411	44.6533
5386.78	330	2.28226	1.01268	44.6556
5455.68	335	2.28246	1.02119	44.6579
5524.4	340	2.28266	1.02965	44.6601
5592.94	345	2.28286	1.03807	44.6622
5661.31	350	2.28305	1.04643	44.6643
5729.5	355	2.28323	1.05475	44.6663
5797.51	360	2.28342	1.06302	44.6683
5865.35	365	2.28359	1.07125	44.6702
5933.02	370	2.28377	1.07943	44.6721
6000.51	375	2.28393	1.08757	44.674
6067.84	380	2.2841	1.09567	44.6758
6135	385	2.28426	1.10372	44.6776
6202	390	2.28442	1.11173	44.6793
6268.83	395	2.28457	1.11971	44.681
6335.49	400	2.28472	1.12764	44.6827
6402	405	2.28487	1.13554	44.6843
6468.34	410	2.28501	1.1434	44.6859
6534.53	415	2.28515	1.15122	44.6875
6600.55	420	2.28529	1.159	44.689
6666.42	425	2.28543	1.16675	44.6905
6732.14	430	2.28556	1.17446	44.692
6797.7	435	2.28569	1.18214	44.6934
6863.1	440	2.28582	1.18978	44.6949
6928.36	445	2.28595	1.1974	44.6963
6993.46	450	2.28607	1.20497	44.6976
7058.41	455	2.28619	1.21252	44.699
7123.21	460	2.28631	1.22003	44.7003
7187.87	465	2.28643	1.22752	44.7016
7252.38	470	2.28654	1.23497	44.7029
7316.74	475	2.28666	1.24239	44.7041
7380.96	480	2.28677	1.24978	44.7054

| Iteración Levenberg-Marquardt 1				
7445.03	485	2.28688	1.25715	44.7066
7508.96	490	2.28698	1.26448	44.7078
7572.75	495	2.28709	1.27179	44.709
7636.4	500	2.28719	1.27907	44.7101
7699.91	505	2.28729	1.28632	44.7113
7763.27	510	2.28739	1.29354	44.7124
7826.5	515	2.28749	1.30074	44.7135
7889.6	520	2.28759	1.30791	44.7146
7952.55	525	2.28769	1.31505	44.7156
8015.38	530	2.28778	1.32217	44.7167
8078.06	535	2.28787	1.32927	44.7177
8140.61	540	2.28796	1.33633	44.7187
8203.03	545	2.28805	1.34338	44.7197
8265.32	550	2.28814	1.3504	44.7207
8327.48	555	2.28823	1.3574	44.7217
8389.5	560	2.28832	1.36437	44.7227
8451.4	565	2.2884	1.37132	44.7236
8513.17	570	2.28848	1.37825	44.7246
8574.8	575	2.28857	1.38515	44.7255
8636.31	580	2.28865	1.39203	44.7264
8697.7	585	2.28873	1.3989	44.7273
8758.96	590	2.28881	1.40573	44.7282
8820.09	595	2.28889	1.41255	44.7291
8881.1	600	2.28896	1.41935	44.7299
8941.98	605	2.28904	1.42612	44.7308
9002.74	610	2.28911	1.43288	44.7316
9063.38	615	2.28919	1.43961	44.7324
9123.9	620	2.28926	1.44633	44.7333
9184.29	625	2.28933	1.45302	44.7341
9244.56	630	2.2894	1.4597	44.7349
9304.72	635	2.28947	1.46635	44.7357
9364.76	640	2.28954	1.47299	44.7364
9424.67	645	2.28961	1.47961	44.7372
9484.47	650	2.28968	1.48621	44.738
9544.15	655	2.28975	1.49279	44.7387
9603.72	660	2.28981	1.49935	44.7395
9663.17	665	2.28988	1.50589	44.7402
9722.5	670	2.28994	1.51242	44.7409
9781.72	675	2.29001	1.51893	44.7416
9840.83	680	2.29007	1.52542	44.7423
9899.82	685	2.29013	1.5319	44.743
9958.69	690	2.29019	1.53835	44.7437
10017.5	695	2.29025	1.54479	44.7444
10076.1	700	2.29031	1.55122	44.7451

Ilustración 69.- Iteración 2 de Levenberg-Marquardt para Suelo Franco Arenoso.
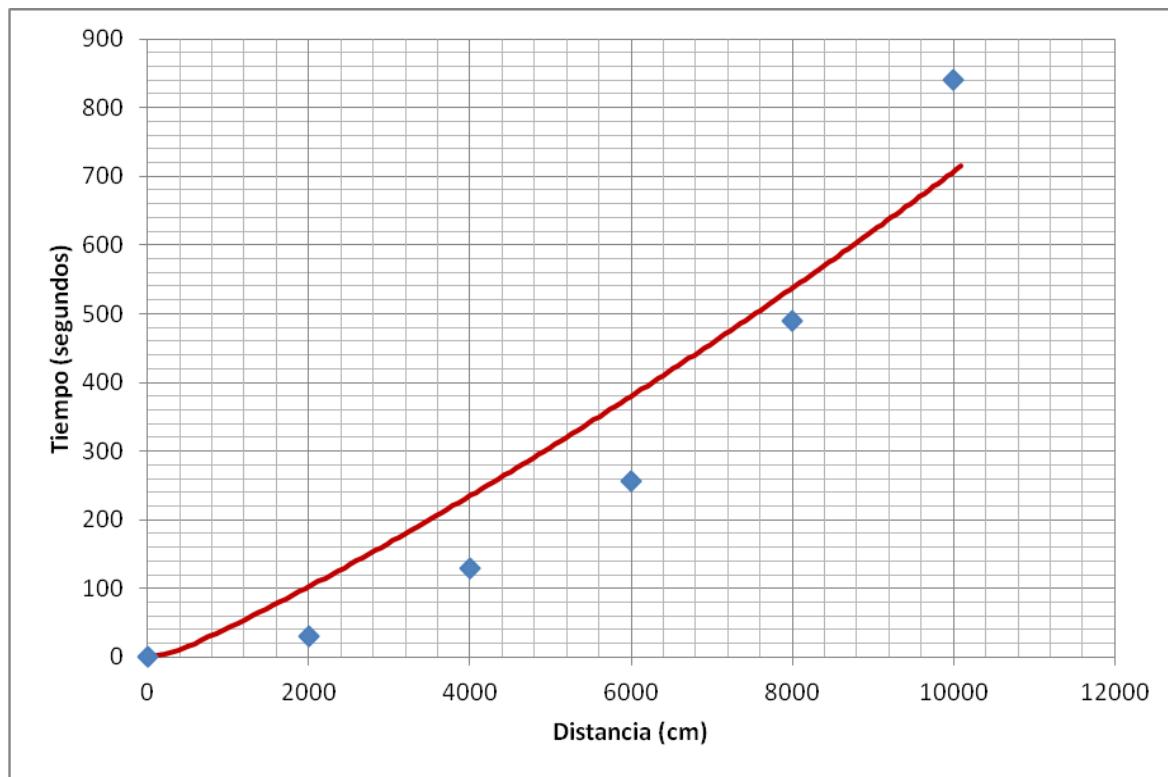
Tabla 22. Segunda iteración Levenberg-Marquardt para suelo franco arenoso

Iteración Levenberg-Marquardt 2				
0	0	0	0	0
203.124	5	1.3149	0.0961705	203.124
379.193	10	1.61852	0.159953	30.7702
496.24	15	1.77036	0.200826	37.5336
581.96	20	1.87189	0.234571	39.7309
672.445	25	1.94602	0.26423	40.9648
765.951	30	2.00281	0.291113	41.7578
857.584	35	2.04753	0.315938	42.3109
947.1	40	2.08335	0.339152	42.7182
1035.77	45	2.11238	0.361058	43.0291
1123.68	50	2.13611	0.381871	43.2725
1210.63	55	2.15565	0.401753	43.4666
1296.66	60	2.17185	0.420829	43.6235
1381.9	65	2.18539	0.439196	43.7521
1466.41	70	2.19676	0.456936	43.8584
1550.23	75	2.20637	0.474114	43.9472
1633.39	80	2.21455	0.490785	44.0219
1715.94	85	2.22155	0.506997	44.0854
1797.92	90	2.22757	0.522788	44.1398
1879.35	95	2.23278	0.538193	44.1866
1960.26	100	2.23732	0.553243	44.2273
2040.68	105	2.24128	0.567963	44.2628
2120.63	110	2.24477	0.582378	44.294
2200.13	115	2.24784	0.596507	44.3216
2279.21	120	2.25057	0.61037	44.3462
2357.87	125	2.25299	0.623983	44.3681
2436.14	130	2.25516	0.63736	44.3878
2514.02	135	2.25711	0.650516	44.4056
2591.53	140	2.25886	0.663463	44.4217
2668.69	145	2.26045	0.676211	44.4363
2745.49	150	2.26189	0.688771	44.4497
2821.96	155	2.2632	0.701153	44.462
2898.11	160	2.2644	0.713365	44.4733
2973.93	165	2.2655	0.725415	44.4837
3049.45	170	2.26651	0.737311	44.4934
3124.66	175	2.26744	0.749058	44.5024
3199.57	180	2.26831	0.760665	44.5108
3274.2	185	2.26911	0.772136	44.5186
3348.54	190	2.26986	0.783477	44.526
3422.6	195	2.27056	0.794694	44.5329
3496.4	200	2.27121	0.80579	44.5394
3569.92	205	2.27183	0.816772	44.5456
3643.18	210	2.2724	0.827642	44.5514
3716.19	215	2.27295	0.838404	44.5569
3788.94	220	2.27346	0.849064	44.5622
3861.44	225	2.27395	0.859623	44.5672
3933.7	230	2.27442	0.870087	44.572
4005.72	235	2.27486	0.880456	44.5765
4077.49	240	2.27528	0.890736	44.5809
4149.04	245	2.27568	0.900928	44.5851
4220.35	250	2.27606	0.911035	44.5891
4291.44	255	2.27643	0.92106	44.593
4362.3	260	2.27678	0.931005	44.5967
4432.94	265	2.27712	0.940873	44.6003
4503.36	270	2.27745	0.950666	44.6038
4573.56	275	2.27776	0.960385	44.6071
4643.55	280	2.27806	0.970033	44.6103
4713.33	285	2.27835	0.979612	44.6135
4782.91	290	2.27864	0.989124	44.6165
4852.27	295	2.27891	0.99857	44.6194
4921.43	300	2.27917	1.00795	44.6223
4990.39	305	2.27943	1.01727	44.625
5059.15	310	2.27967	1.02653	44.6277
5127.72	315	2.27991	1.03573	44.6303
5196.09	320	2.28015	1.04487	44.6329
5264.26	325	2.28037	1.05396	44.6353
5332.25	330	2.28059	1.06299	44.6377
5400.04	335	2.28081	1.07196	44.6401
5467.65	340	2.28102	1.08089	44.6423
5535.07	345	2.28122	1.08976	44.6446
5602.31	350	2.28142	1.09858	44.6467
5669.36	355	2.28161	1.10735	44.6488
5736.24	360	2.2818	1.11608	44.6509
5802.94	365	2.28198	1.12475	44.6529
5869.46	370	2.28216	1.13339	44.6549
5935.8	375	2.28234	1.14197	44.6568
6001.97	380	2.28251	1.15051	44.6587
6067.96	385	2.28268	1.15901	44.6606
6133.79	390	2.28284	1.16746	44.6624
6199.44	395	2.283	1.17588	44.6641
6264.93	400	2.28316	1.18425	44.6659
6330.25	405	2.28331	1.19258	44.6676
6395.41	410	2.28346	1.20087	44.6692
6460.4	415	2.28361	1.20912	44.6709
6525.22	420	2.28375	1.21734	44.6725
6589.89	425	2.28389	1.22552	44.674

| Iteración Levenberg-Marquardt 2				
6654.39	430	2.28403	1.23366	44.6756
6718.74	435	2.28417	1.24176	44.6771
6782.93	440	2.2843	1.24983	44.6786
6846.96	445	2.28443	1.25787	44.68
6910.83	450	2.28456	1.26587	44.6814
6974.55	455	2.28469	1.27383	44.6828
7038.12	460	2.28481	1.28177	44.6842
7101.53	465	2.28493	1.28967	44.6856
7164.8	470	2.28505	1.29754	44.6869
7227.91	475	2.28517	1.30538	44.6882
7290.87	480	2.28528	1.31318	44.6895
7353.69	485	2.2854	1.32096	44.6908
7416.36	490	2.28551	1.32871	44.692
7478.88	495	2.28562	1.33642	44.6932
7541.26	500	2.28572	1.34411	44.6944
7603.49	505	2.28583	1.35177	44.6956
7665.59	510	2.28593	1.3594	44.6968
7727.53	515	2.28604	1.367	44.6979
7789.34	520	2.28614	1.37458	44.6991
7851.01	525	2.28624	1.38212	44.7002
7912.54	530	2.28634	1.38965	44.7013
7973.92	535	2.28643	1.39714	44.7023
8035.18	540	2.28653	1.40461	44.7034
8096.29	545	2.28662	1.41205	44.7044
8157.27	550	2.28671	1.41947	44.7055
8218.11	555	2.2868	1.42687	44.7065
8278.82	560	2.28689	1.43424	44.7075
8339.4	565	2.28698	1.44158	44.7085
8399.84	570	2.28707	1.4489	44.7095
8460.15	575	2.28715	1.4562	44.7104
8520.33	580	2.28724	1.46348	44.7114
8580.38	585	2.28732	1.47073	44.7123
8640.3	590	2.2874	1.47796	44.7132
8700.09	595	2.28749	1.48516	44.7141
8759.76	600	2.28757	1.49235	44.715
8819.29	605	2.28764	1.49951	44.7159
8878.7	610	2.28772	1.50665	44.7168
8937.99	615	2.2878	1.51377	44.7177
8997.15	620	2.28787	1.52087	44.7185
9056.18	625	2.28795	1.52795	44.7194
9115.09	630	2.28802	1.53501	44.7202
9173.88	635	2.2881	1.54205	44.721
9232.55	640	2.28817	1.54907	44.7218
9291.09	645	2.28824	1.55607	44.7226
9349.51	650	2.28831	1.56305	44.7234
9407.81	655	2.28838	1.57001	44.7242
9466	660	2.28845	1.57695	44.725
9524.06	665	2.28852	1.58387	44.7257
9582.01	670	2.28858	1.59077	44.7265
9639.83	675	2.28865	1.59766	44.7272
9697.54	680	2.28871	1.60452	44.728
9755.14	685	2.28878	1.61137	44.7287
9812.61	690	2.28884	1.6182	44.7294
9869.98	695	2.28891	1.62502	44.7301
9927.22	700	2.28897	1.63181	44.7308
9984.36	705	2.28903	1.63859	44.7315
10041.4	710	2.28909	1.64536	44.7322
10098.3	715	2.28915	1.6521	44.7329

Ilustración 70.- Iteración 3 de Levenberg-Marquardt para Suelo Franco Arenoso.

Tabla 23. Tercera iteración Levenberg-Marquardt para suelo franco arenoso
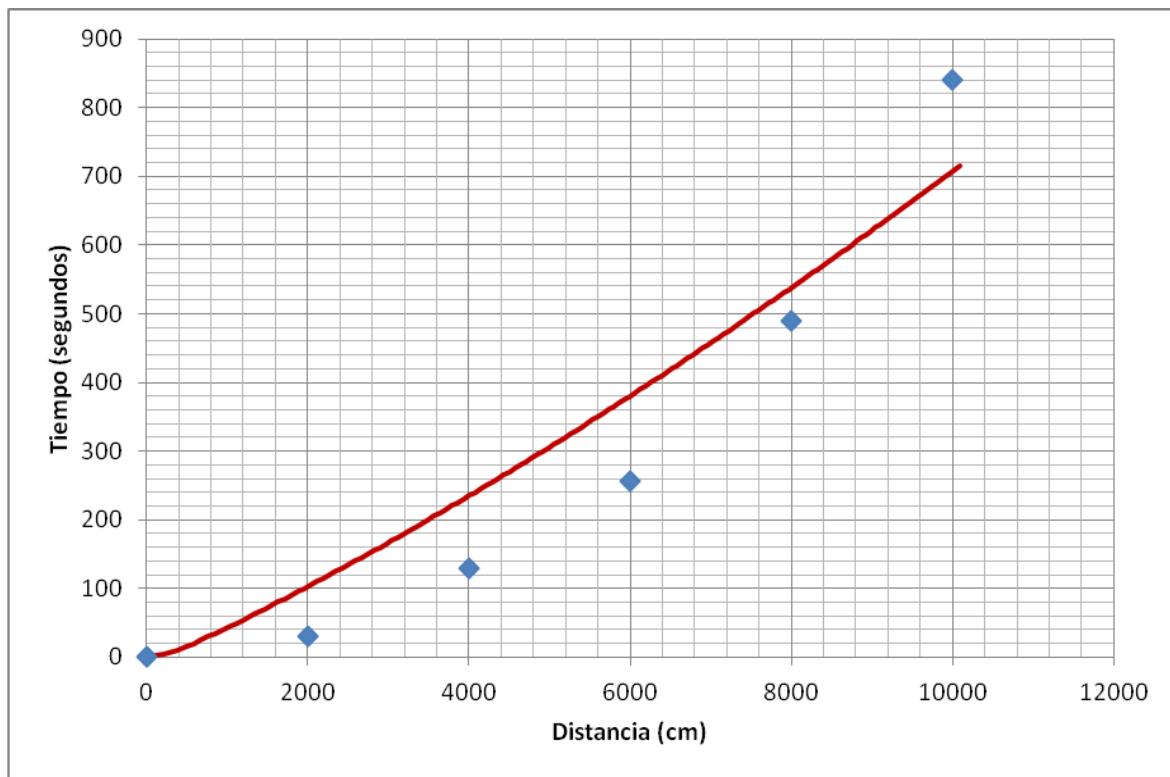
Iteración Levenberg-Marquardt 3					Iteración Levenberg-Marquardt 3					Iteración Levenberg-Marquardt 3				
0	0	0	0	0	1959.77	100	2.23722	0.554293	44.2262	3495.22	200	2.27113	0.807356	44.5385
203.098	5	1.31488	0.0963477	203.098	2040.16	105	2.24118	0.569043	44.2617	3568.71	205	2.27174	0.818361	44.5447
379.143	10	1.61849	0.160245	30.7682	2120.08	110	2.24467	0.583487	44.2929	3641.93	210	2.27232	0.829253	44.5505
496.165	15	1.77031	0.201195	37.5321	2199.56	115	2.24774	0.597644	44.3206	3714.89	215	2.27287	0.840039	44.5561
581.867	20	1.87183	0.235003	39.7295	2278.6	120	2.25047	0.611535	44.3451	3787.61	220	2.27338	0.850721	44.5613
672.335	25	1.94595	0.264717	40.9635	2357.23	125	2.2529	0.625175	44.3671	3860.07	225	2.27387	0.861302	44.5664
765.822	30	2.00272	0.291651	41.7565	2435.46	130	2.25507	0.63858	44.3868	3932.29	230	2.27434	0.871787	44.5711
857.433	35	2.04744	0.316524	42.3096	2513.31	135	2.25702	0.651763	44.4046	4004.26	235	2.27478	0.882179	44.5757
946.927	40	2.08326	0.339783	42.7169	2590.79	140	2.25877	0.664735	44.4207	4076	240	2.2752	0.89248	44.5801
1035.57	45	2.11228	0.361731	43.0278	2667.91	145	2.26036	0.67751	44.4353	4147.5	245	2.2756	0.902694	44.5843
1123.46	50	2.136	0.382584	43.2712	2744.68	150	2.2618	0.690096	44.4487	4218.77	250	2.27599	0.912822	44.5883
1210.39	55	2.15554	0.402505	43.4653	2821.12	155	2.26311	0.702503	44.461	4289.82	255	2.27635	0.922869	44.5922
1296.39	60	2.17175	0.421617	43.6223	2897.23	160	2.26431	0.71474	44.4723	4360.64	260	2.27671	0.932835	44.5959
1381.61	65	2.18528	0.440021	43.7508	2973.02	165	2.26541	0.726815	44.4828	4431.23	265	2.27705	0.942724	44.5995
1466.1	70	2.19665	0.457796	43.8572	3048.49	170	2.26642	0.738735	44.4925	4501.61	270	2.27737	0.952537	44.603
1549.89	75	2.20626	0.475007	43.9459	3123.67	175	2.26736	0.750507	44.5015	4571.77	275	2.27769	0.962277	44.6063
1633.02	80	2.21444	0.491711	44.0207	3198.55	180	2.26822	0.762137	44.5099	4641.72	280	2.27799	0.971946	44.6096
1715.54	85	2.22144	0.507955	44.0843	3273.14	185	2.26903	0.773632	44.5177	4711.46	285	2.27828	0.981545	44.6127
1797.49	90	2.22747	0.523777	44.1386	3347.44	190	2.26978	0.784997	44.5251	4780.99	290	2.27856	0.991077	44.6157
1878.89	95	2.23268	0.539213	44.1855	3421.47	195	2.27047	0.796237	44.532	4850.31	295	2.27884	1.00054	44.6187

Iteración Levenberg-Marquardt 3					Iteración Levenberg-Marquardt 3			
4919.42	300	2.2791	1.00995	44.6215	7908.25	530	2.28628	1.39248	44.7006
4988.34	305	2.27936	1.01929	44.6243	7969.59	535	2.28637	1.39999	44.7017
5057.06	310	2.2796	1.02856	44.627	8030.78	540	2.28647	1.40748	44.7028
5125.58	315	2.27984	1.03778	44.6296	8091.84	545	2.28656	1.41494	44.7038
5193.9	320	2.28008	1.04695	44.6321	8152.77	550	2.28665	1.42237	44.7049
5262.03	325	2.2803	1.05605	44.6346	8213.56	555	2.28674	1.42978	44.7059
5329.97	330	2.28052	1.0651	44.637	8274.21	560	2.28683	1.43717	44.7069
5397.72	335	2.28074	1.0741	44.6393	8334.73	565	2.28692	1.44453	44.7079
5465.28	340	2.28095	1.08304	44.6416	8395.12	570	2.28701	1.45187	44.7088
5532.65	345	2.28115	1.09193	44.6438	8455.38	575	2.2871	1.45918	44.7098
5599.84	350	2.28135	1.10077	44.646	8515.5	580	2.28718	1.46647	44.7108
5666.85	355	2.28154	1.10956	44.6481	8575.5	585	2.28726	1.47374	44.7117
5733.68	360	2.28173	1.11831	44.6502	8635.36	590	2.28735	1.48099	44.7126
5800.33	365	2.28192	1.127	44.6522	8695.1	595	2.28743	1.48821	44.7135
5866.8	370	2.2821	1.13565	44.6542	8754.71	600	2.28751	1.49541	44.7144
5933.1	375	2.28227	1.14425	44.6561	8814.19	605	2.28759	1.50259	44.7153
5999.22	380	2.28244	1.15281	44.658	8873.54	610	2.28766	1.50975	44.7162
6065.16	385	2.28261	1.16133	44.6599	8932.77	615	2.28774	1.51689	44.7171
6130.94	390	2.28277	1.1698	44.6617	8991.87	620	2.28782	1.524	44.7179
6196.55	395	2.28293	1.17823	44.6635	9050.85	625	2.28789	1.5311	44.7188
6261.99	400	2.28309	1.18662	44.6652	9109.71	630	2.28797	1.53817	44.7196
6327.26	405	2.28324	1.19497	44.6669	9168.44	635	2.28804	1.54523	44.7204
6392.36	410	2.2834	1.20328	44.6686	9227.05	640	2.28811	1.55226	44.7212
6457.3	415	2.28354	1.21156	44.6702	9285.53	645	2.28818	1.55928	44.722
6522.08	420	2.28369	1.21979	44.6718	9343.9	650	2.28825	1.56627	44.7228
6586.69	425	2.28383	1.22798	44.6734	9402.14	655	2.28832	1.57325	44.7236
6651.15	430	2.28397	1.23614	44.6749	9460.27	660	2.28839	1.5802	44.7244
6715.44	435	2.2841	1.24427	44.6764	9518.28	665	2.28846	1.58714	44.7251
6779.58	440	2.28424	1.25235	44.6779	9576.16	670	2.28853	1.59406	44.7259
6843.56	445	2.28437	1.26041	44.6793	9633.93	675	2.28859	1.60096	44.7266
6907.39	450	2.2845	1.26842	44.6808	9691.59	680	2.28866	1.60784	44.7274
6971.06	455	2.28462	1.27641	44.6822	9749.12	685	2.28872	1.61471	44.7281
7034.57	460	2.28475	1.28436	44.6836	9806.54	690	2.28879	1.62156	44.7288
7097.93	465	2.28487	1.29228	44.6849	9863.85	695	2.28885	1.62839	44.7295
7161.15	470	2.28499	1.30017	44.6862	9921.04	700	2.28891	1.6352	44.7302
7224.21	475	2.28511	1.30802	44.6876	9978.11	705	2.28897	1.64199	44.7309
7287.12	480	2.28522	1.31584	44.6888	10035.1	710	2.28903	1.64877	44.7316
7349.88	485	2.28533	1.32364	44.6901	10091.9	715	2.2891	1.65553	44.7323
7412.5	490	2.28545	1.3314	44.6914					
7474.97	495	2.28556	1.33913	44.6926					
7537.3	500	2.28566	1.34684	44.6938					
7599.48	505	2.28577	1.35452	44.695					
7661.51	510	2.28587	1.36216	44.6961					
7723.41	515	2.28598	1.36978	44.6973					
7785.16	520	2.28608	1.37737	44.6984					
7846.78	525	2.28618	1.38494	44.6995					

Tiempo (segundos) / Distancia (cm)

Ilustración 71.- Iteración 4 de Levenberg-Marquardt para Suelo Franco Arenoso.

Tabla 24. Cuarta iteración Levenberg-Marquardt para suelo franco arenoso

Iteración Levenberg-Marquardt 4				
0	0	0	0	0
203.067	5	1.31485	0.0965686	203.067
379.081	10	1.61845	0.160609	30.7658
496.071	15	1.77025	0.201654	37.5304
581.751	20	1.87176	0.235541	39.7279
672.198	25	1.94586	0.265325	40.9619
765.661	30	2.00262	0.292322	41.7549
857.246	35	2.04733	0.317254	42.308
946.713	40	2.08314	0.340568	42.7153
1035.33	45	2.11216	0.362569	43.0262
1123.19	50	2.13588	0.383472	43.2696
1210.09	55	2.15541	0.403441	43.4637
1296.06	60	2.17162	0.4226	43.6207
1381.25	65	2.18515	0.441048	43.7493
1465.7	70	2.19652	0.458866	43.8556
1549.46	75	2.20613	0.47612	43.9444
1632.56	80	2.21431	0.492865	44.0193
1715.04	85	2.22131	0.509148	44.0828
1796.95	90	2.22734	0.52501	44.1372
1878.32	95	2.23255	0.540484	44.1841

Iteración Levenberg-Marquardt 4				
1959.16	100	2.23709	0.555601	44.2248
2039.52	105	2.24106	0.570388	44.2603
2119.4	110	2.24454	0.584868	44.2916
2198.83	115	2.24762	0.599061	44.3192
2277.84	120	2.25035	0.612987	44.3438
2356.43	125	2.25278	0.626661	44.3658
2434.62	130	2.25495	0.6401	44.3855
2512.43	135	2.2569	0.653315	44.4033
2589.86	140	2.25865	0.666321	44.4194
2666.94	145	2.26024	0.679128	44.4341
2743.67	150	2.26169	0.691746	44.4475
2820.07	155	2.263	0.704185	44.4598
2896.13	160	2.2642	0.716453	44.4712
2971.88	165	2.2653	0.728559	44.4816
3047.31	170	2.26631	0.740509	44.4913
3122.44	175	2.26725	0.752311	44.5003
3197.27	180	2.26812	0.763972	44.5087
3271.81	185	2.26892	0.775496	44.5166
3346.07	190	2.26967	0.786891	44.524
3420.05	195	2.27037	0.798159	44.5309
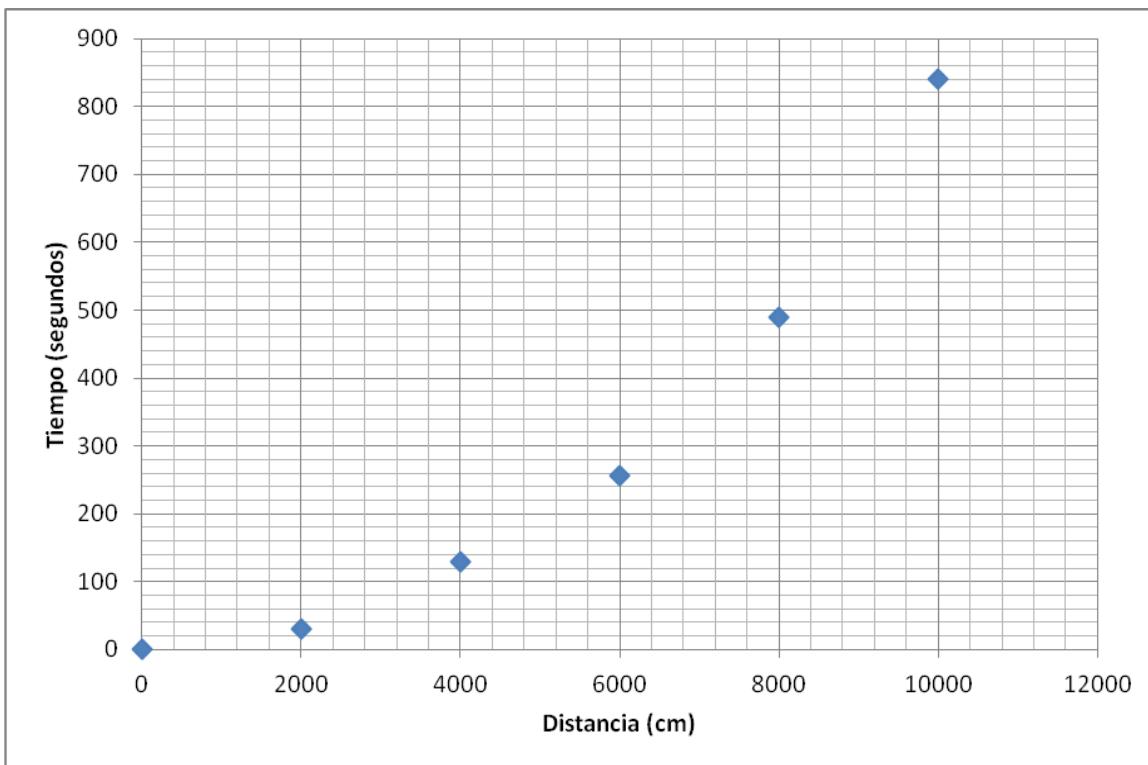
Iteración Levenberg-Marquardt 4				
3493.75	200	2.27103	0.809308	44.5374
3567.19	205	2.27164	0.820341	44.5436
3640.37	210	2.27222	0.831262	44.5495
3713.28	215	2.27277	0.842075	44.555
3785.95	220	2.27329	0.852785	44.5603
3858.36	225	2.27378	0.863394	44.5653
3930.53	230	2.27424	0.873907	44.5701
4002.45	235	2.27468	0.884326	44.5747
4074.14	240	2.27511	0.894654	44.5791
4145.59	245	2.27551	0.904894	44.5833
4216.81	250	2.27589	0.915049	44.5873
4287.8	255	2.27626	0.925122	44.5912
4358.57	260	2.27661	0.935115	44.5949
4429.11	265	2.27695	0.94503	44.5985
4499.44	270	2.27728	0.954869	44.602
4569.55	275	2.2776	0.964635	44.6054
4639.44	280	2.2779	0.974329	44.6086
4709.12	285	2.27819	0.983954	44.6117
4778.59	290	2.27847	0.993512	44.6148
4847.86	295	2.27875	1.003	44.6177

"Diseño y aplicación de riego por gravedad"

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DEL AGUA

Iteración Levenberg-Marquardt 4				
4916.92	300	2.27901	1.01243	44.6206
4985.78	305	2.27927	1.0218	44.6233
5054.44	310	2.27952	1.0311	44.626
5122.91	315	2.27976	1.04034	44.6287
5191.17	320	2.27999	1.04953	44.6312
5259.25	325	2.28022	1.05866	44.6337
5327.13	330	2.28044	1.06773	44.6361
5394.82	335	2.28065	1.07675	44.6384
5462.32	340	2.28086	1.08572	44.6407
5529.64	345	2.28107	1.09463	44.6429
5596.77	350	2.28127	1.1035	44.6451
5663.72	355	2.28146	1.11231	44.6472
5730.49	360	2.28165	1.12108	44.6493
5797.08	365	2.28183	1.1298	44.6513
5863.49	370	2.28201	1.13847	44.6533
5929.73	375	2.28219	1.1471	44.6553
5995.79	380	2.28236	1.15568	44.6572
6061.68	385	2.28253	1.16422	44.659
6127.39	390	2.28269	1.17272	44.6608
6192.94	395	2.28285	1.18117	44.6626
6258.32	400	2.28301	1.18959	44.6643
6323.53	405	2.28316	1.19796	44.666
6388.57	410	2.28331	1.20629	44.6677
6453.45	415	2.28346	1.21458	44.6693
6518.17	420	2.28361	1.22284	44.6709
6582.72	425	2.28375	1.23106	44.6725
6647.11	430	2.28389	1.23924	44.6741
6711.34	435	2.28402	1.24739	44.6756
6775.42	440	2.28416	1.25549	44.6771
6839.33	445	2.28429	1.26357	44.6785
6903.09	450	2.28442	1.27161	44.68
6966.7	455	2.28454	1.27962	44.6814
7030.15	460	2.28467	1.28759	44.6827
7093.45	465	2.28479	1.29553	44.6841
7156.6	470	2.28491	1.30344	44.6854
7219.6	475	2.28503	1.31132	44.6867
7282.44	480	2.28514	1.31916	44.688
7345.14	485	2.28526	1.32698	44.6893
7407.69	490	2.28537	1.33476	44.6905
7470.1	495	2.28548	1.34252	44.6918
7532.36	500	2.28559	1.35024	44.693
7594.47	505	2.28569	1.35794	44.6942
7656.45	510	2.2858	1.36561	44.6953
7718.28	515	2.2859	1.37325	44.6965
7779.96	520	2.286	1.38086	44.6976
7841.51	525	2.2861	1.38845	44.6987
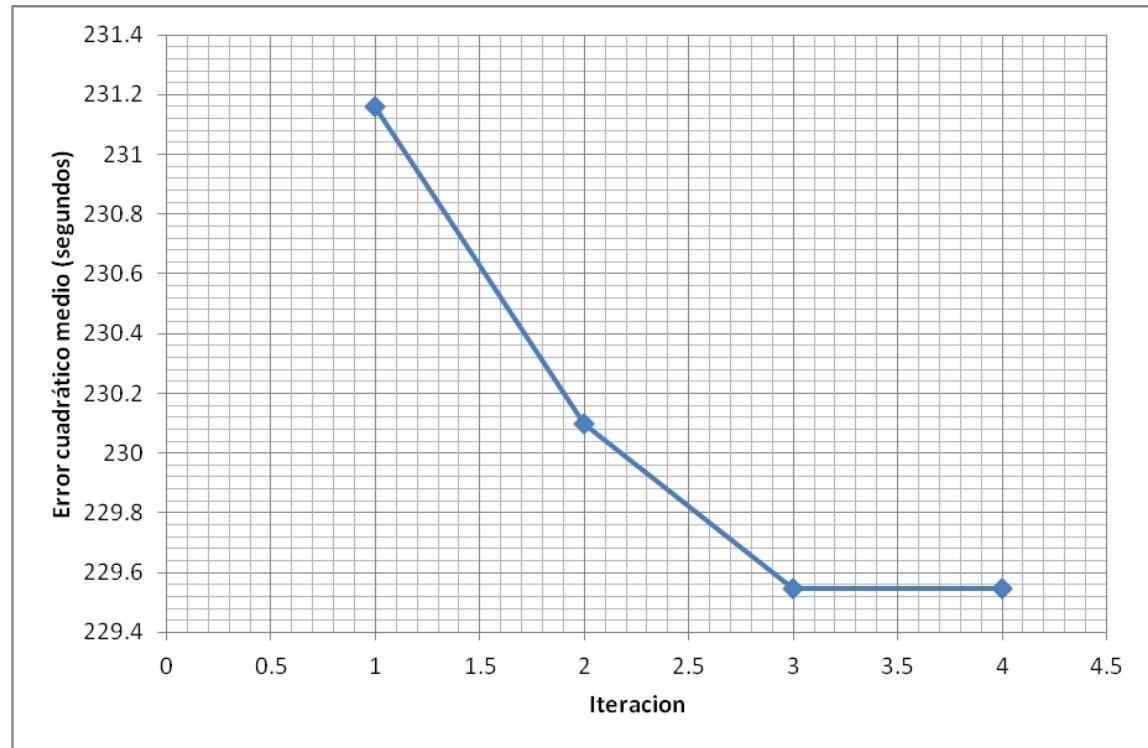
Iteración Levenberg-Marquardt 4				
7902.92	530	2.2862	1.39601	44.6998
7964.19	535	2.2863	1.40354	44.7009
8025.32	540	2.28639	1.41105	44.702
8086.31	545	2.28649	1.41853	44.703
8147.17	550	2.28658	1.42599	44.7041
8207.89	555	2.28667	1.43342	44.7051
8268.47	560	2.28676	1.44082	44.7061
8328.93	565	2.28685	1.44821	44.7071
8389.25	570	2.28694	1.45556	44.7081
8449.44	575	2.28702	1.4629	44.709
8509.49	580	2.28711	1.47021	44.71
8569.42	585	2.28719	1.4775	44.7109
8629.22	590	2.28727	1.48477	44.7119
8688.88	595	2.28735	1.49201	44.7128
8748.42	600	2.28743	1.49923	44.7137
8807.83	605	2.28751	1.50643	44.7146
8867.12	610	2.28759	1.51361	44.7154
8926.28	615	2.28767	1.52077	44.7163
8985.31	620	2.28775	1.5279	44.7172
9044.22	625	2.28782	1.53502	44.718
9103	630	2.28789	1.54211	44.7188
9161.66	635	2.28797	1.54919	44.7197
9220.2	640	2.28804	1.55624	44.7205
9278.62	645	2.28811	1.56327	44.7213
9336.91	650	2.28818	1.57029	44.7221
9395.09	655	2.28825	1.57729	44.7229
9453.14	660	2.28832	1.58426	44.7236
9511.08	665	2.28839	1.59122	44.7244
9568.89	670	2.28846	1.59816	44.7252
9626.59	675	2.28852	1.60508	44.7259
9684.17	680	2.28859	1.61198	44.7266
9741.63	685	2.28865	1.61887	44.7274
9798.98	690	2.28872	1.62573	44.7281
9856.21	695	2.28878	1.63258	44.7288
9913.33	700	2.28884	1.63941	44.7295
9970.33	705	2.2889	1.64623	44.7302
10027.2	710	2.28897	1.65302	44.7309
10084	715	2.28903	1.6598	44.7316

ECM			
iteración	ECM	Ks	hf
1	231.162	1.91384	8.48945
2	230.1	1.92064	8.48974
3	229.545	1.92913	8.49012
4	229.545	1.93765	8.49051

observados	
0	0
2000	30
4000	130
6000	256
8000	490
10000	840

Ilustración 72.- Tiempo y distancia observados para Suelo Franco Arenoso.
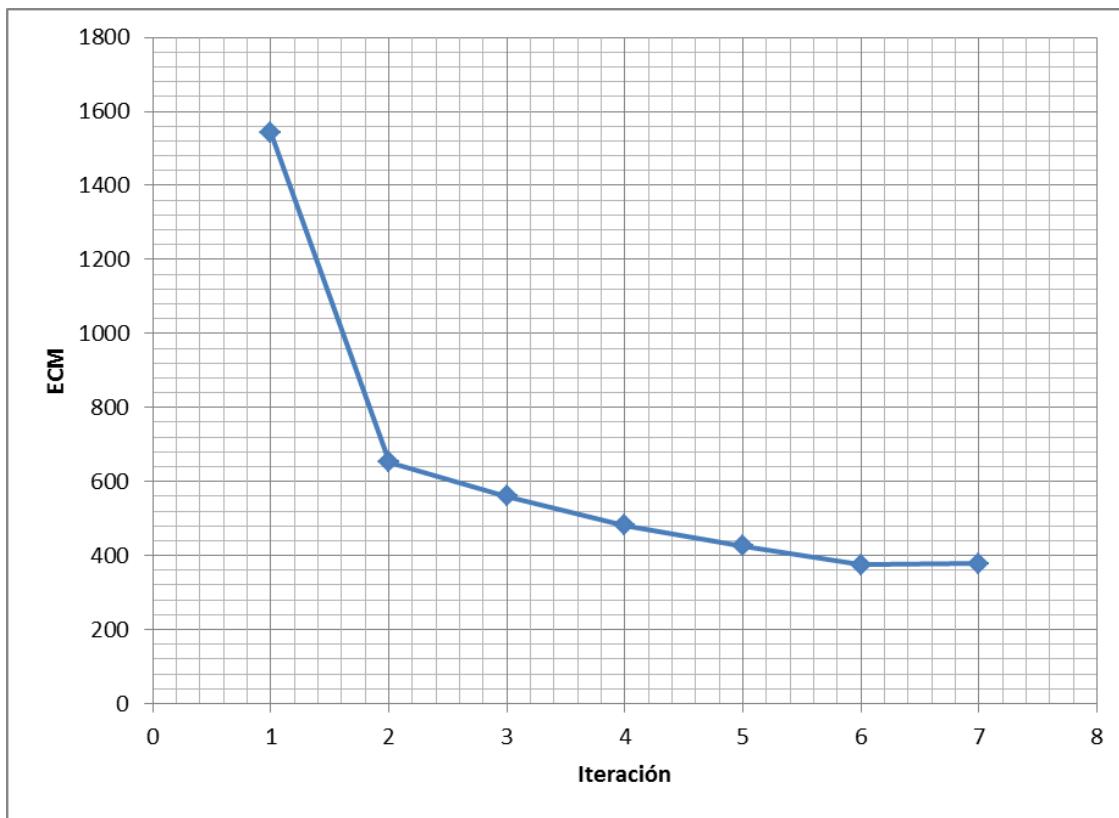
Ilustración 73.- Error cuadrático medio Suelo Franco Arenoso.

3.5. Cálculo de evolución del error cuadrático medio en pruebas de avance de riego por gravedad en un suelo franco.

El objetivo del diseño de riego por melgas es conseguir la aplicación de una lámina de riego requerida por el cultivo de la manera más uniforme posible, conservando una eficiencia de aplicación alta. El diseño del riego consiste en determinar el gasto de aporte y el tiempo durante el cual se aplica dicho gasto en la cabecera de la melga para lograr la mayor uniformidad posible; es decir, en determinar el gasto óptimo para una longitud de melga específica y una caracterización hidrodinámica del suelo dada. Para realizar dicha caracterización hidrodinámica puede utilizarse por ejemplo, información de una prueba de avance de riego, a partir de la cual se realiza el procedimiento de ajuste u optimización de los parámetros buscando minimizar el error obtenido entre las observaciones realizadas y las obtenidas mediante el modelo empleado para la simulación de la fase de avance del riego por gravedad.
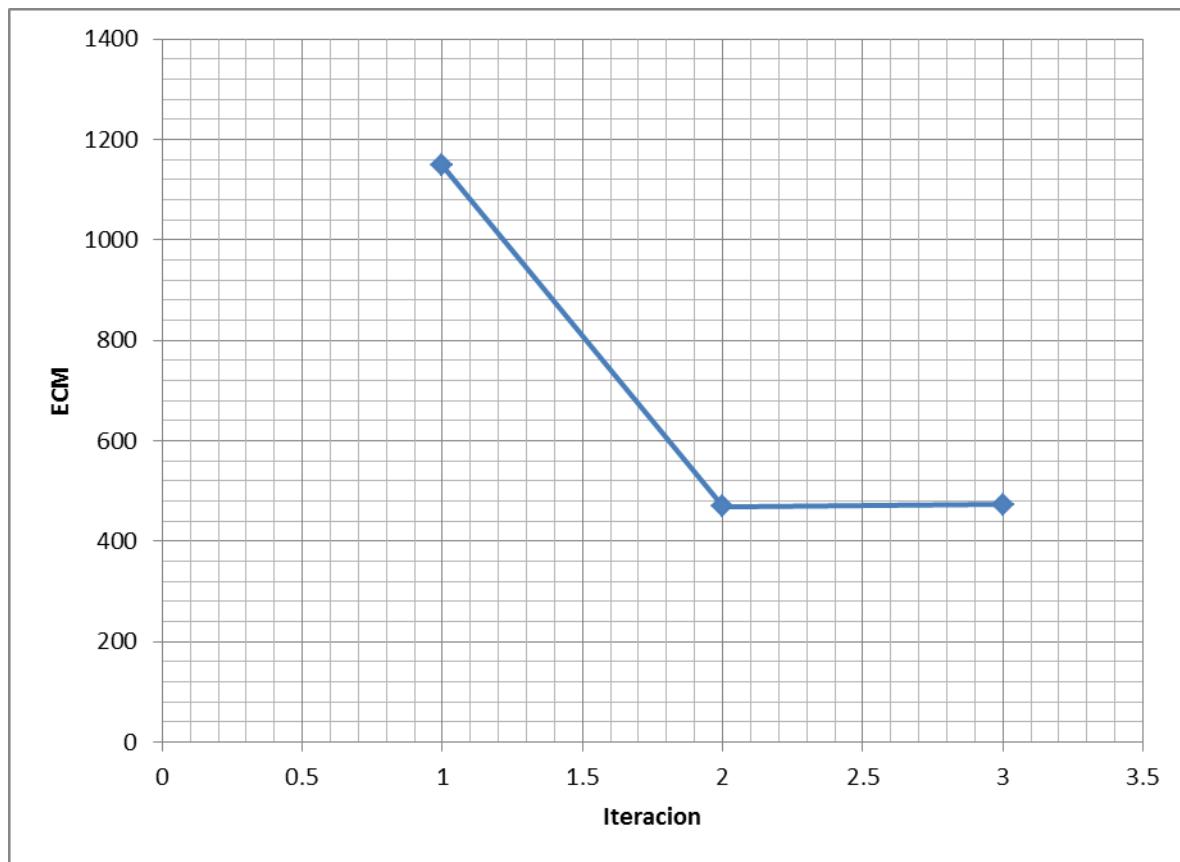
En este sentido, se verificó la evolución del error cuadrático medio en un suelo franco a partir de asignaciones automáticas de los valores iniciales en el proceso de optimización de parámetros.

arcilla 8 % - arena 39%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	1542.25	0.845775	1.93355	-1.00505	54.2066	-0.0369601
2	651.64	0.577473	1.81662	-0.116932	54.2039	-0.00269887
3	560.379	0.140048	1.72195	-0.0946721	54.2018	-0.00205305
4	482.011	0.139848	1.64391	-0.0780397	54.2002	-0.00160423
5	425.382	0.117485	1.57843	-0.0654817	54.1989	-0.00128511
6	375.08	0.118252	1.58484	0.00641305	54.199	3.59E-05
7	378.761	0.0098143	1.59029	0.00544845	54.199	3.19E-05
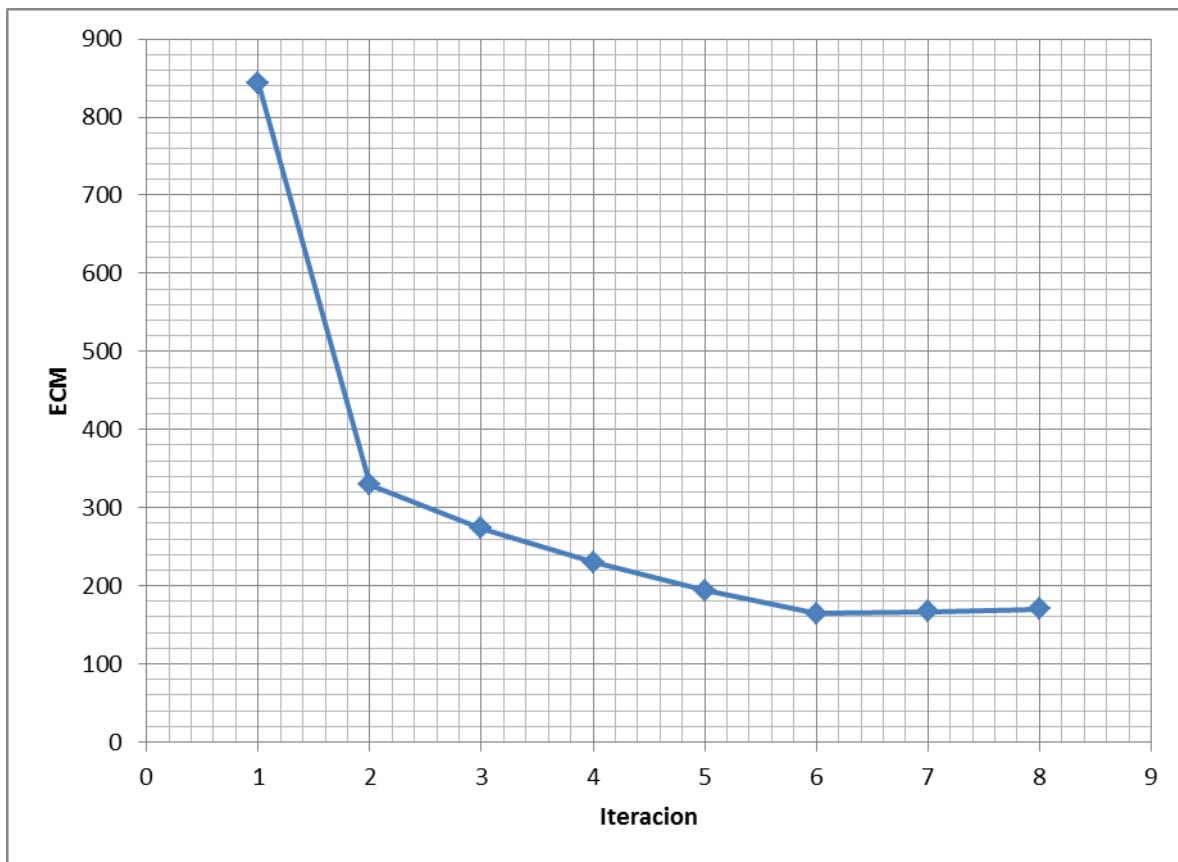
Ilustración 74.- Arcilla 8%-Arena 39%

arcilla 10 % - arena 39%						
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	1148.44	0.885156	1.70137	-0.821053	54.1495	-0.0270367
2	469.596	0.591101	1.71123	0.00985755	54.1496	5.98E-05
3	473.387	0.00807325	1.71957	0.0083477	54.1496	5.28E-05
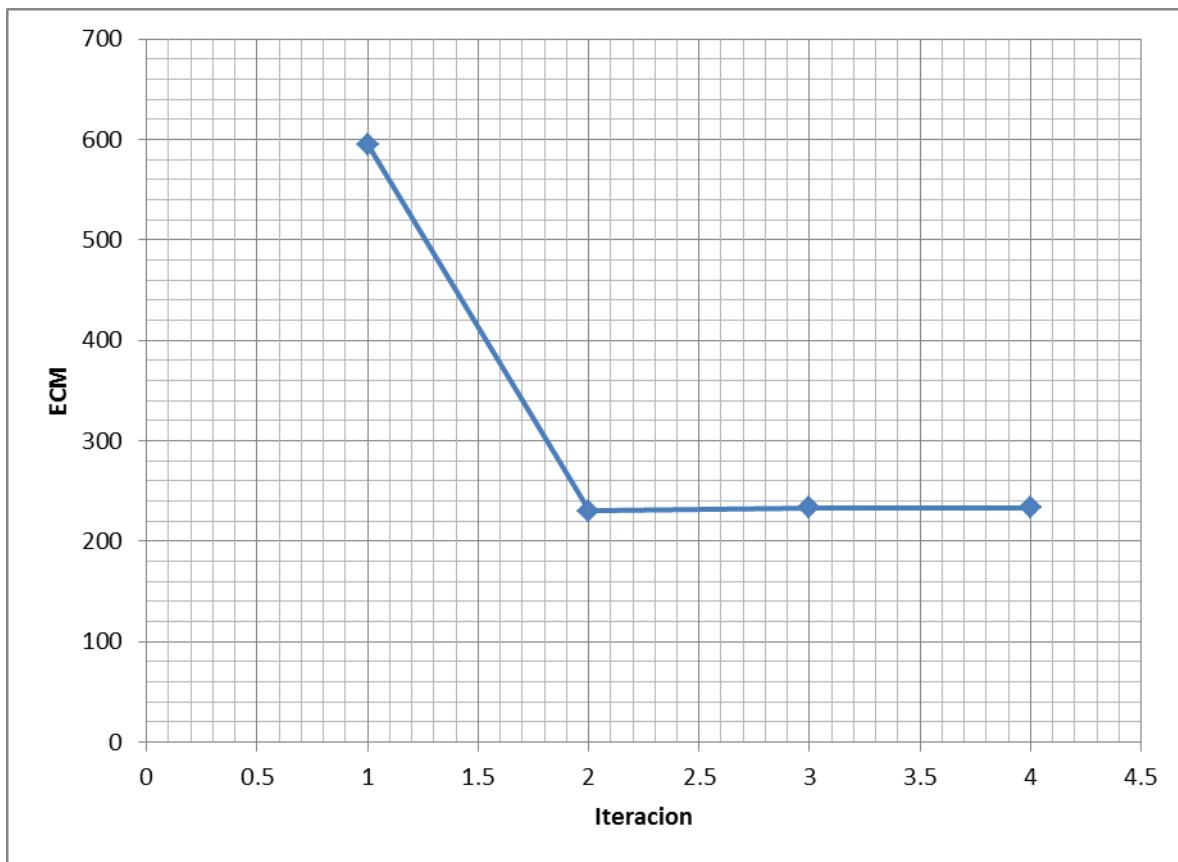
Ilustración 75.- Arcilla 10%-Arena 39%

iteración	ECM	control ECM	Ks	var Ks	hf	var hf
arcilla 12 % - arena 39%						
1	843.513	0.915649	1.52176	-0.650143	54.0613	-0.0191646
2	329.538	0.609327	1.44363	-0.0781286	54.0597	-0.00157493
3	273.633	0.169646	1.38193	-0.0617041	54.0585	-0.00118002
4	229.772	0.160293	1.33237	-0.04956	54.0576	-0.00090729
5	193.598	0.157435	1.29203	-0.0403352	54.0569	-0.00071194
6	164.104	0.152346	1.29493	0.00289425	54.0569	1.31E-05
7	167.197	0.0188531	1.2975	0.00257305	54.0569	1.23E-05
8	170.235	0.018168	1.30012	0.00262015	54.057	1.26E-05
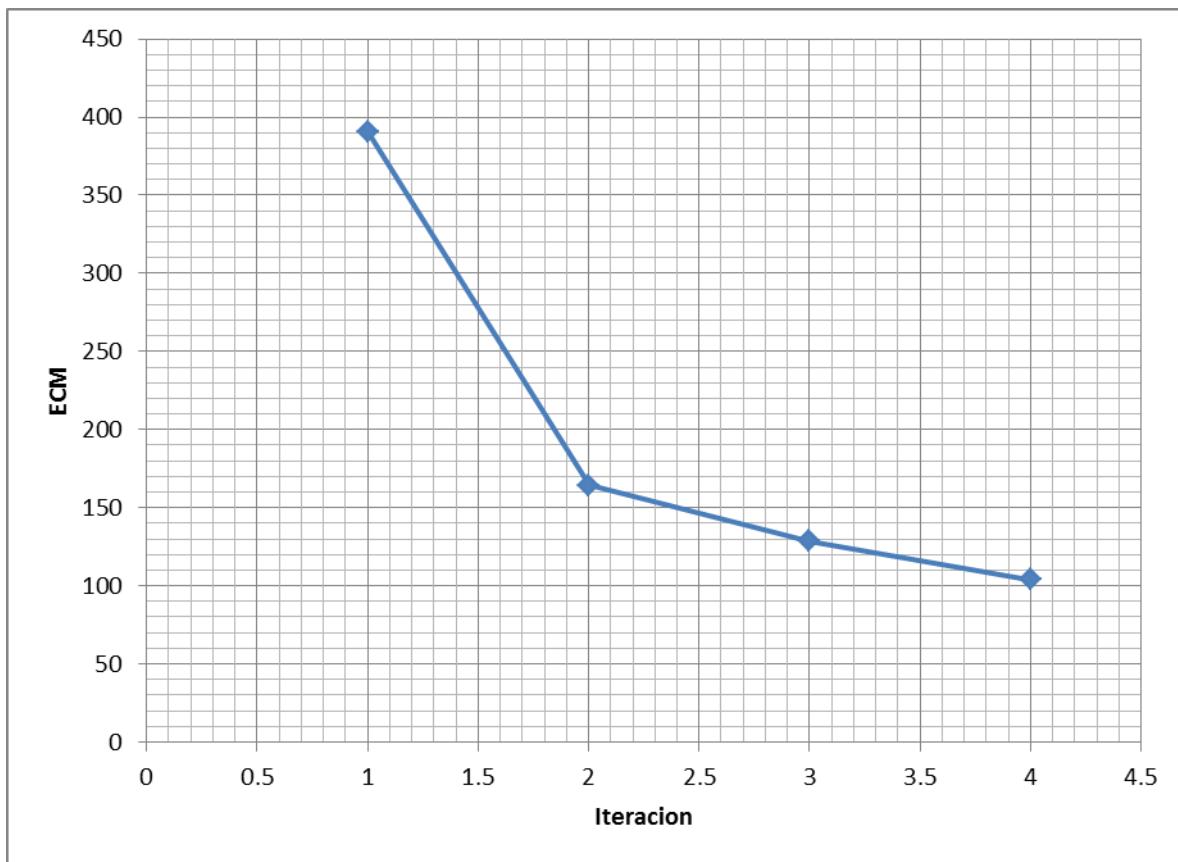
Ilustración 76.- Arcilla 12%-Arena 39%

arcilla 14 % - arena 39%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	595.244	0.940476	1.38549	-0.486188	53.9421	-0.0130805
2	229.772	0.613987	1.39037	0.00487969	53.9422	2.41E-05
3	233.174	0.0148066	1.39459	0.00421725	53.9422	2.17E-05
4	233.313	0.00059758	1.39887	0.00428016	53.9422	2.21E-05
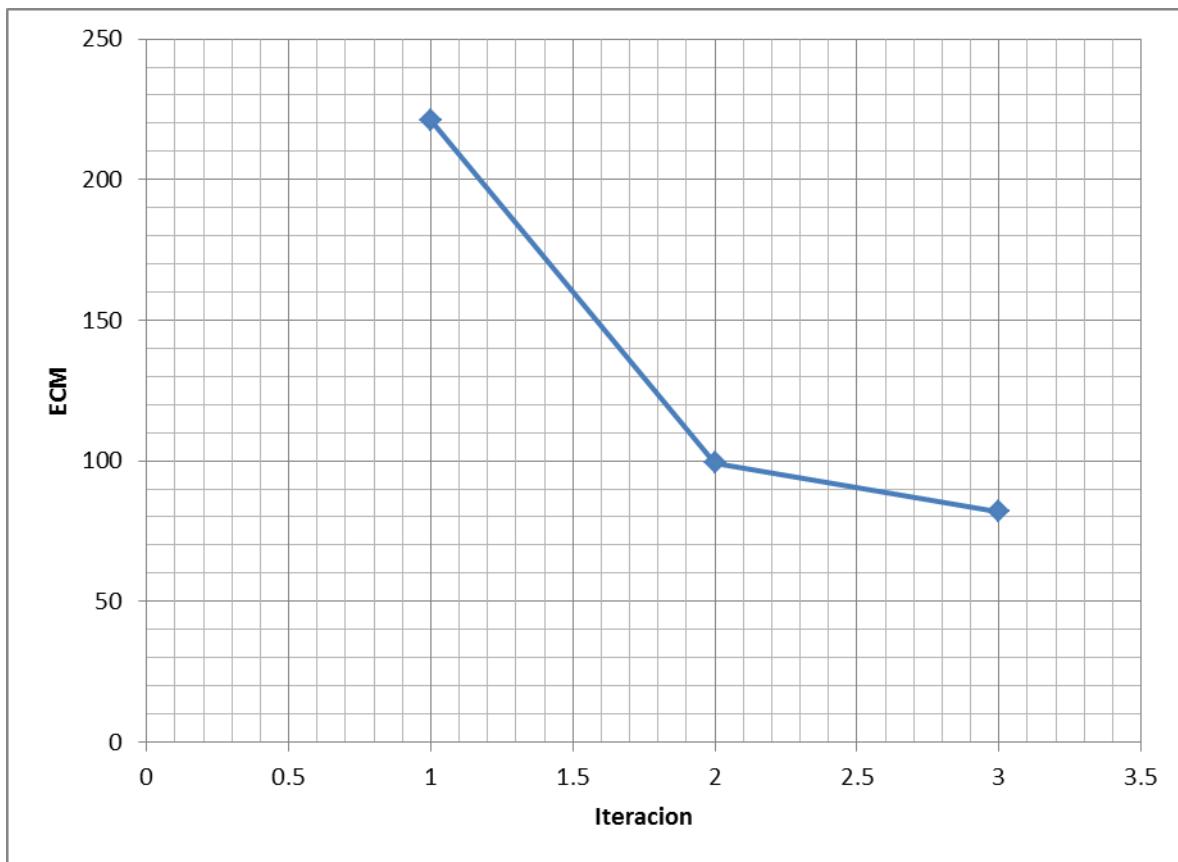
Ilustración 77.- Arcilla 14%-Arena 39%

arcilla 16 % - arena 39%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	390.781	0.960922	1.28894	-0.322706	53.7934	-0.00750581
2	164.104	0.580063	1.23952	-0.0494193	53.7925	-0.00087964
3	128.686	0.215827	1.20301	-0.0365095	53.7918	-0.00062495
4	103.779	0.19355	1.20494	0.00193622	53.7919	8.13E-06
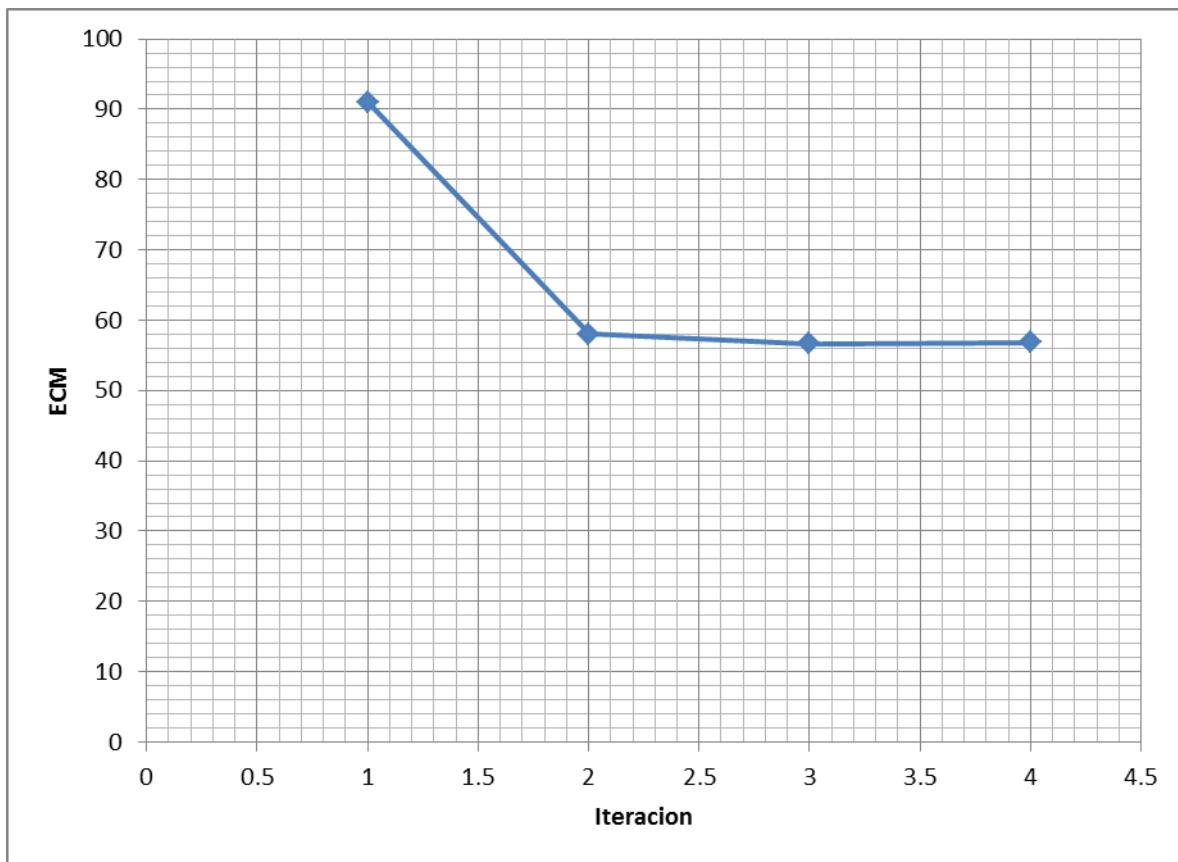
Ilustración 78.- Arcilla 16%-Arena 39%

arcilla 18 % - arena 39%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	221.292	0.977871	1.19575	-0.189041	53.6135	-0.0039425
2	99.3479	0.551055	1.16349	-0.0322553	53.6129	-0.00055859
3	82.0366	0.174249	1.16491	0.00141731	53.6129	0.00000566
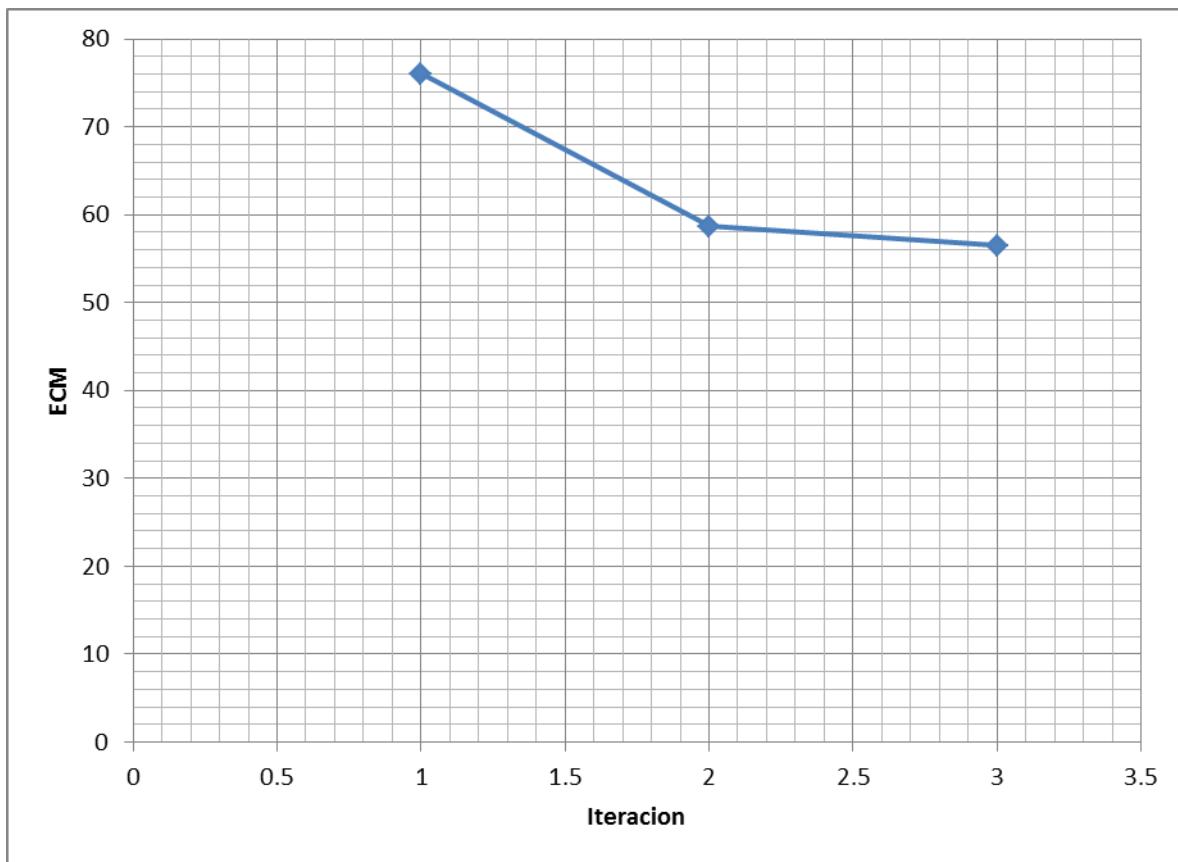
Ilustración 79.- Arcilla 18%-Arena 39%

arcilla 20 % - arena 39%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	91.0769	0.990892	1.1135	-0.0724951	53.4037	-0.00136636
2	58.0086	0.363081	1.10048	-0.0130167	53.4034	-0.00022965
3	56.701	0.0225423	1.08987	-0.0106076	53.4032	-0.00018496
4	56.8771	0.0031056	1.0816	-0.00827022	53.4031	-0.00014282
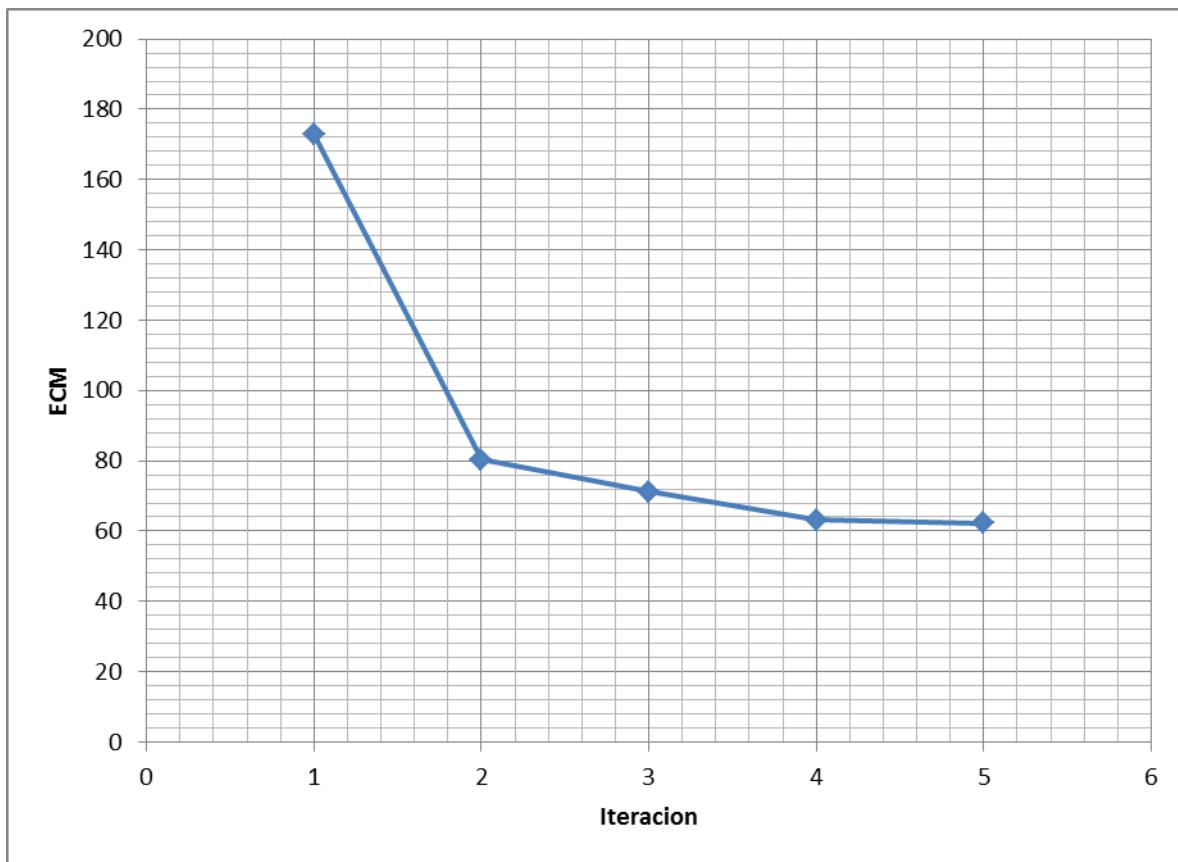
Ilustración 80.- Arcilla 20%-Arena 39%

arcilla 22 % - arena 39%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	76.0263	0.992397	1.06213	0.0507543	53.1644	0.00079746
2	58.6941	0.227976	1.06548	0.00334669	53.1645	5.59E-05
3	56.5243	0.0369678	1.06625	0.00077475	53.1645	1.30E-05
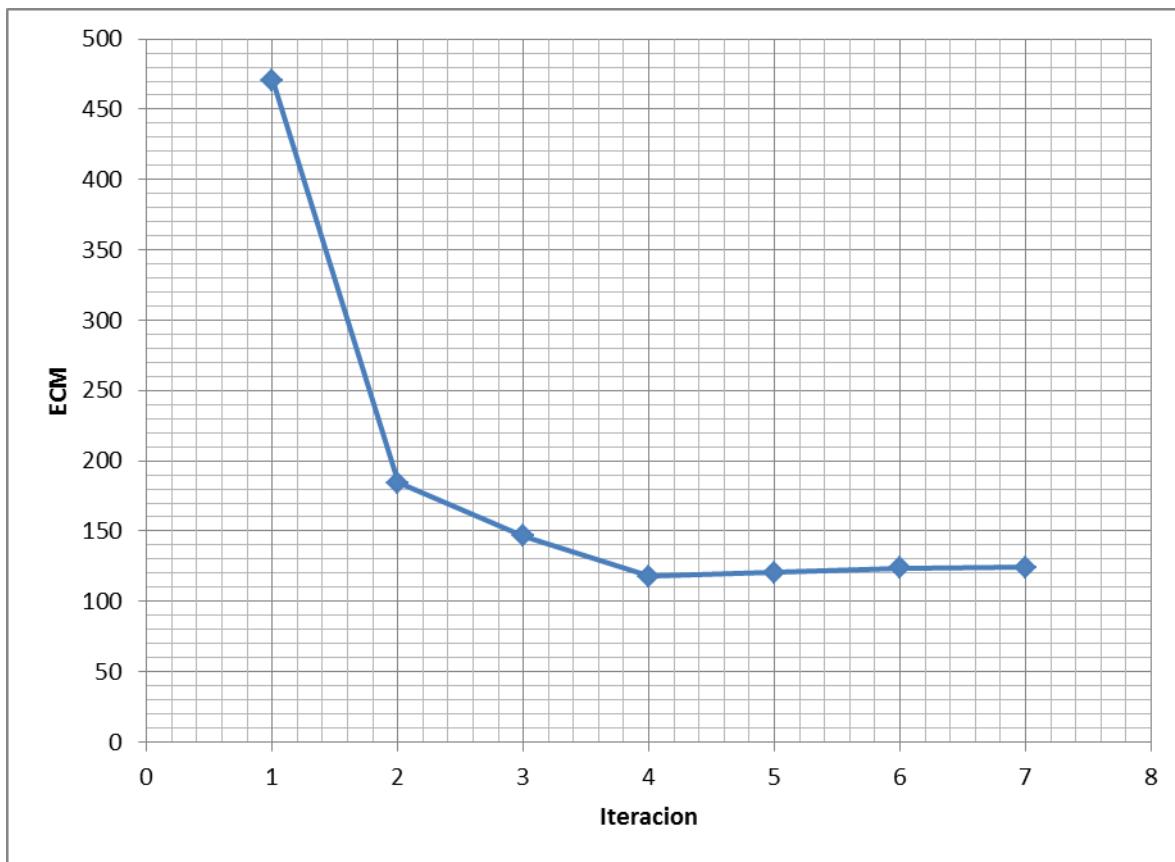
Ilustración 81.- Arcilla 22%-Arena 39%

arcilla 24 % - arena 39%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	172.931	0.982707	1.01222	0.154327	52.8954	0.00198618
2	80.343	0.535403	1.03192	0.0197015	52.8957	0.00030161
3	71.2039	0.113751	1.04513	0.0132064	52.8959	0.00020611
4	63.206	0.112324	1.05432	0.00919559	52.896	0.00014535
5	62.2093	0.0157689	1.05388	-0.00044654	52.896	-2.04E-06
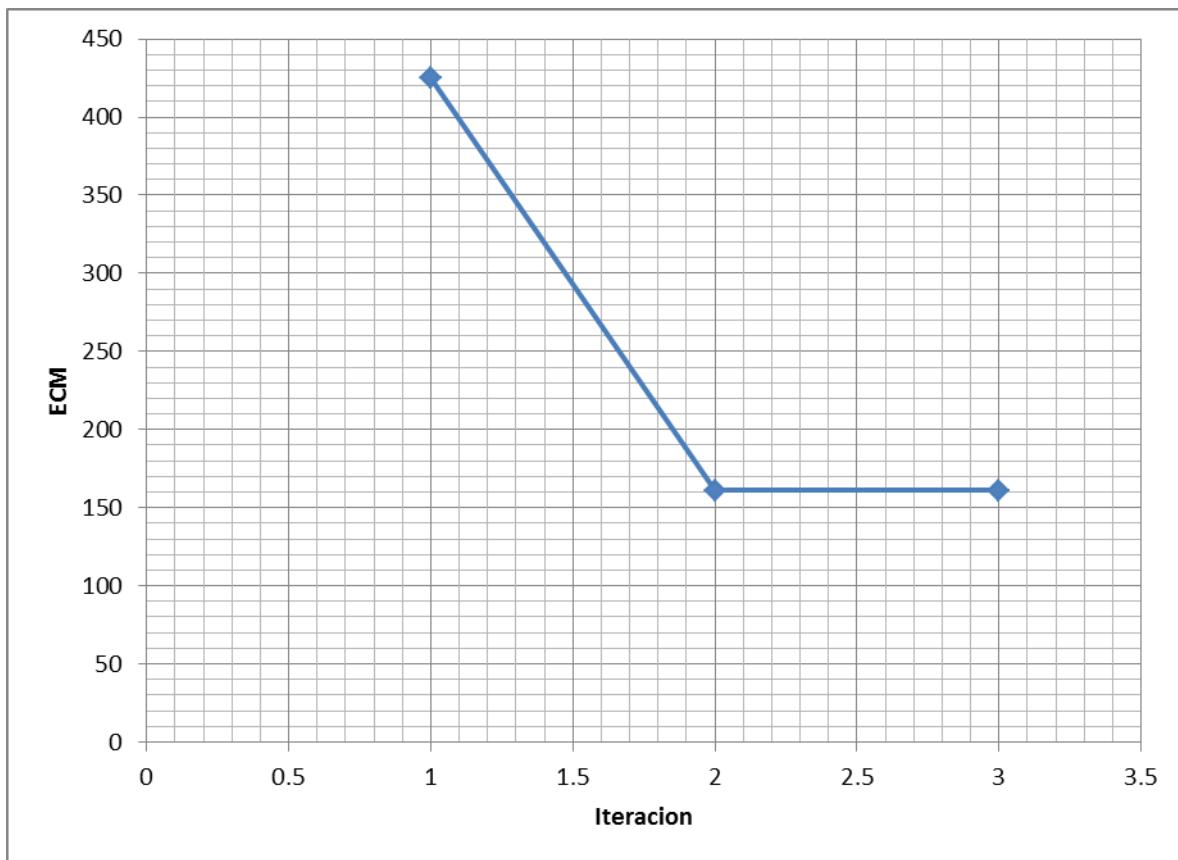
Ilustración 82.- Arcilla 24%-Arena 39%

arcilla 17 % - arena 25%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	470.755	0.952925	0.835485	-0.264622	92.3915	-0.00265824
2	184.31	0.608481	0.799203	-0.0362826	92.3912	-0.00026873
3	146.39	0.205739	0.771599	-0.0276033	92.391	-0.00019557
4	117.941	0.194339	0.77302	0.00142044	92.391	2.24E-06
5	120.354	0.0204593	0.774301	0.00128172	92.391	2.14E-06
6	123.531	0.0264032	0.775615	0.00131343	92.391	2.20E-06
7	124.358	0.0066945	0.77696	0.00134529	92.3911	2.26E-06
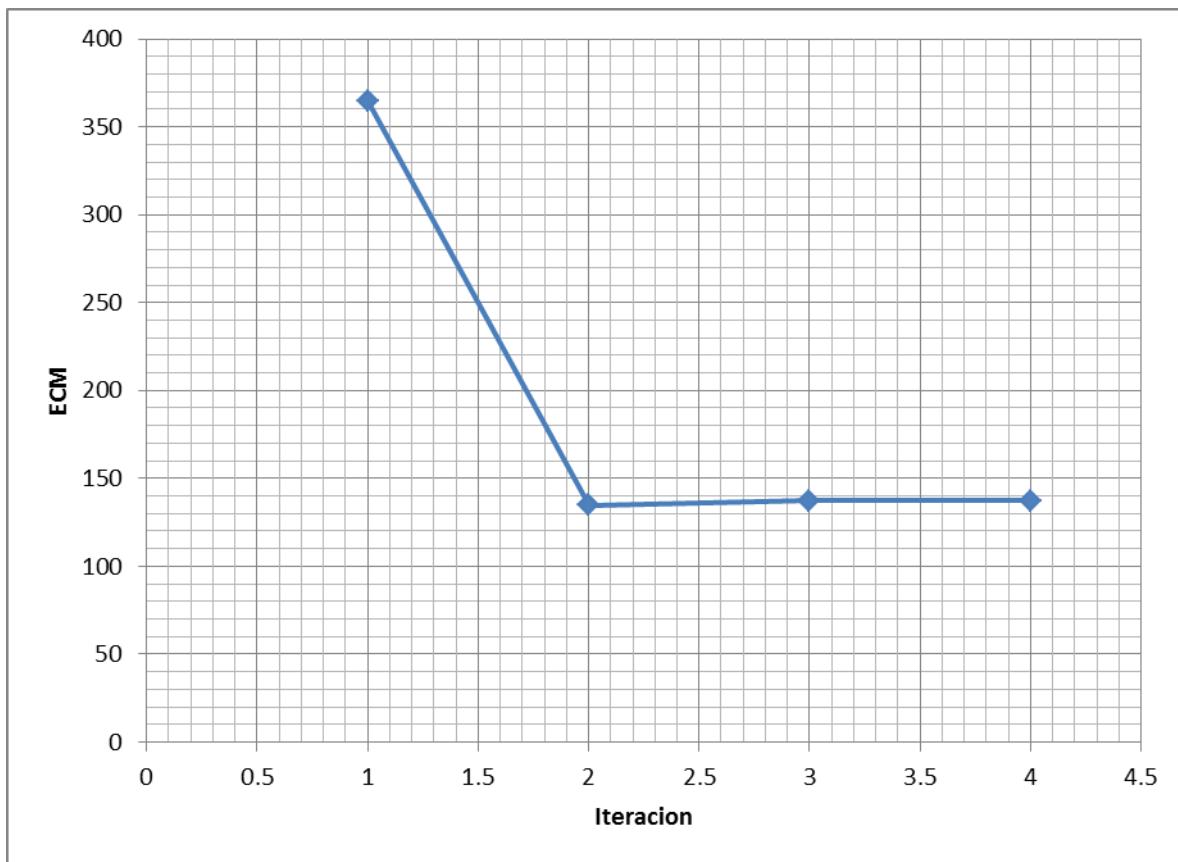
Ilustración 83.- Arcilla 17%-Arena 25%

arcilla 17 % - arena 30%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	425.112	0.957489	0.951443	-0.281966	77.1224	-0.00379404
2	161.106	0.621028	0.953969	0.00252625	77.1224	5.91E-06
3	161.106	0.001	0.956178	0.00220918	77.1224	5.47E-06
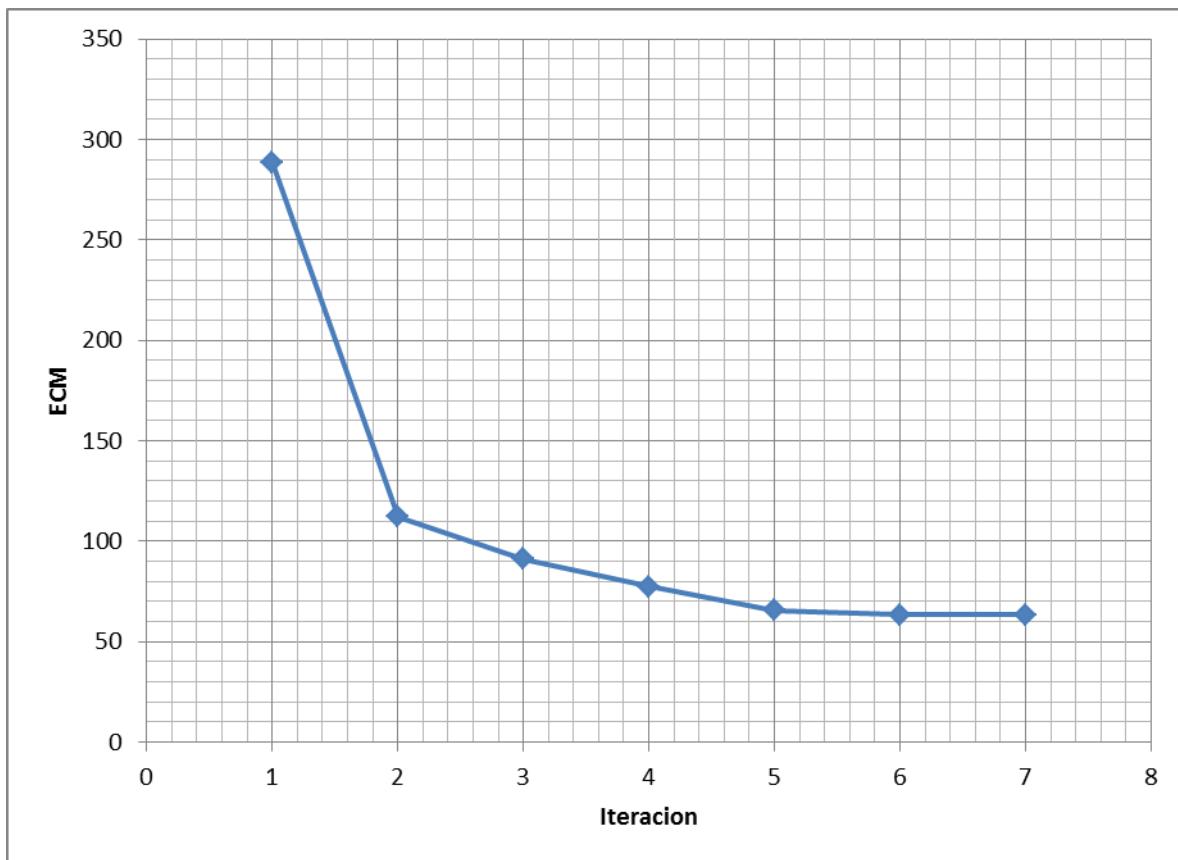
Ilustración 84.- Arcilla 17%-Arena 30%

arcilla 17 % - arena 35%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	364.979	0.963502	1.08936	-0.285716	63.5003	-0.00525311
2	134.573	0.631285	1.09179	0.00243668	63.5003	7.96E-06
3	137.241	0.0198201	1.09396	0.00216603	63.5003	7.45E-06
4	137.241	0.001	1.09613	0.00217033	63.5003	7.48E-06
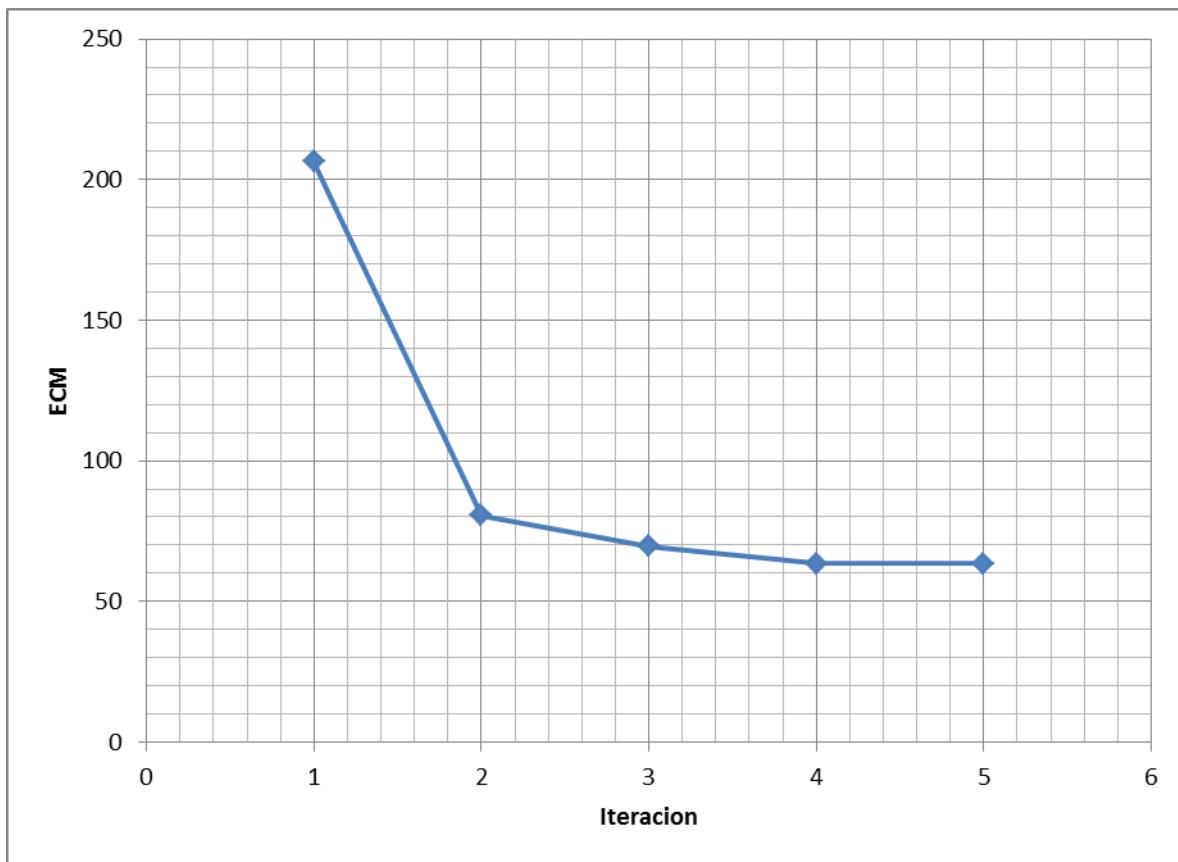
Ilustración 85.- Arcilla 17%-Arena 35%

arcilla 17 % - arena 40%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	288.444	0.971156	1.26386	-0.261241	51.404	-0.00617298
2	112.227	0.610921	1.22698	-0.0368769	51.4033	-0.0007052
3	91.0769	0.188462	1.19845	-0.0285321	51.4028	-0.00052971
4	77.3305	0.150932	1.17679	-0.0216561	51.4024	-0.00039271
5	65.6125	0.151531	1.15988	-0.0169074	51.4021	-0.00030106
6	63.364	0.0342689	1.16058	0.00070005	51.4021	2.67E-06
7	63.364	0.001	1.16133	0.0007447	51.4021	3.36E-06
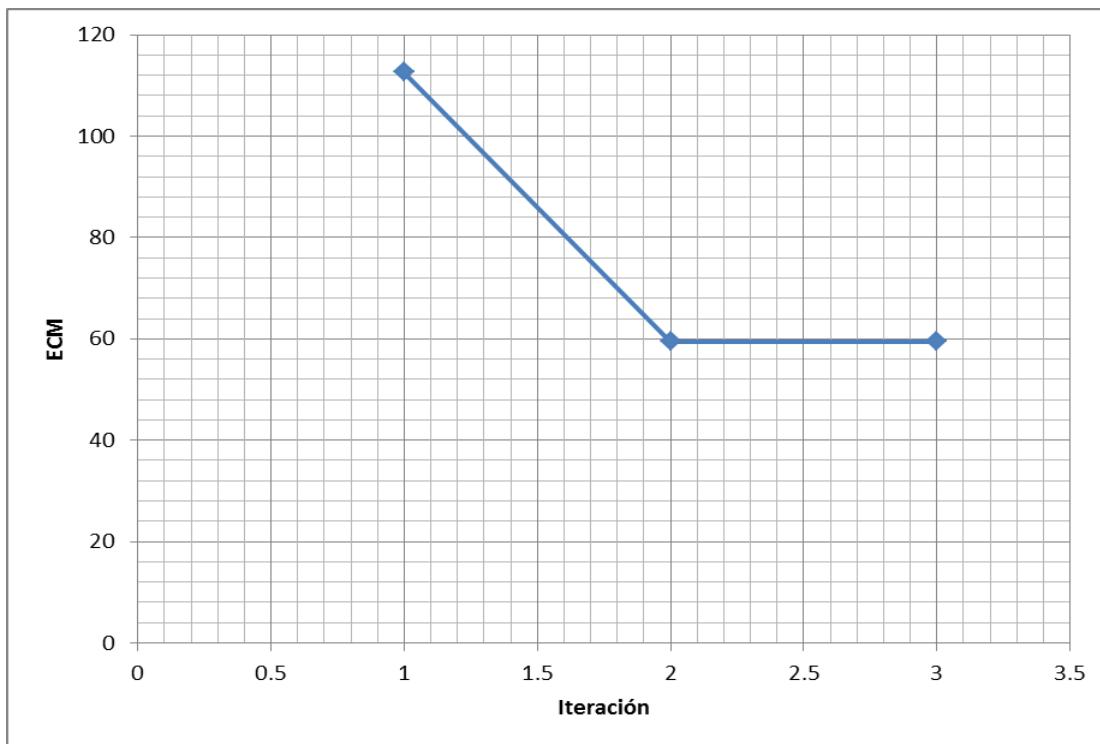
Ilustración 86.- Arcilla 17%-Arena 40%

arcilla 17 % - arena 45%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	206.47	0.979353	1.45992	-0.223552	40.7198	-0.0075432
2	80.4984	0.610121	1.42782	-0.0321018	40.7189	-0.00089198
3	69.6778	0.13442	1.40237	-0.0254503	40.7182	-0.00069163
4	63.364	0.0906142	1.40325	0.00088346	40.7182	5.21E-06
5	63.364	0.001	1.40419	0.00093852	40.7183	6.47E-06
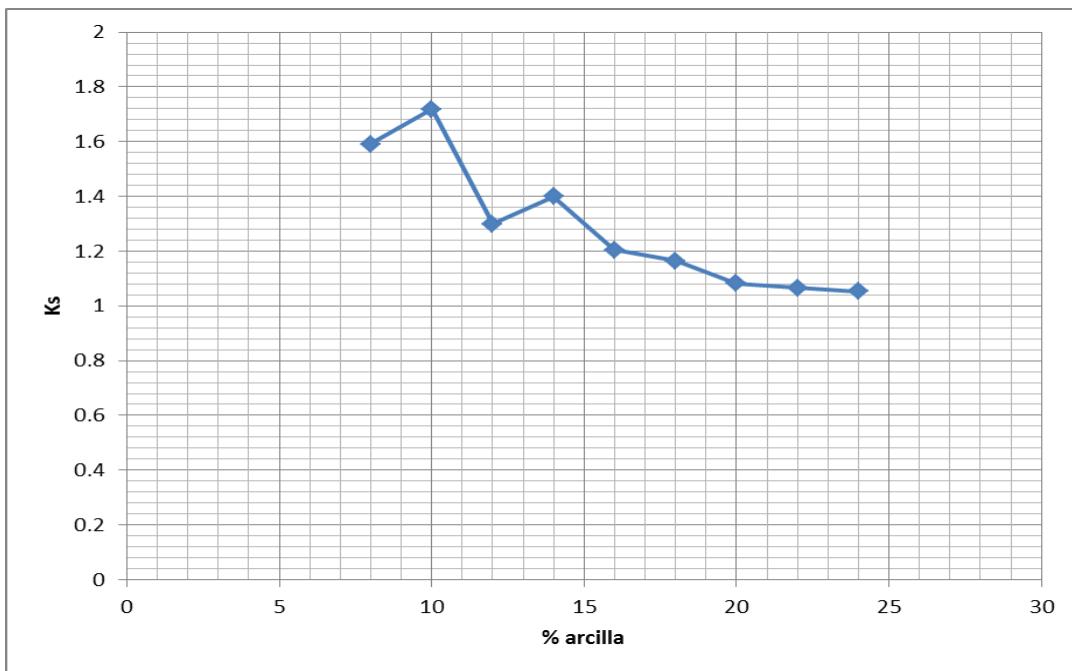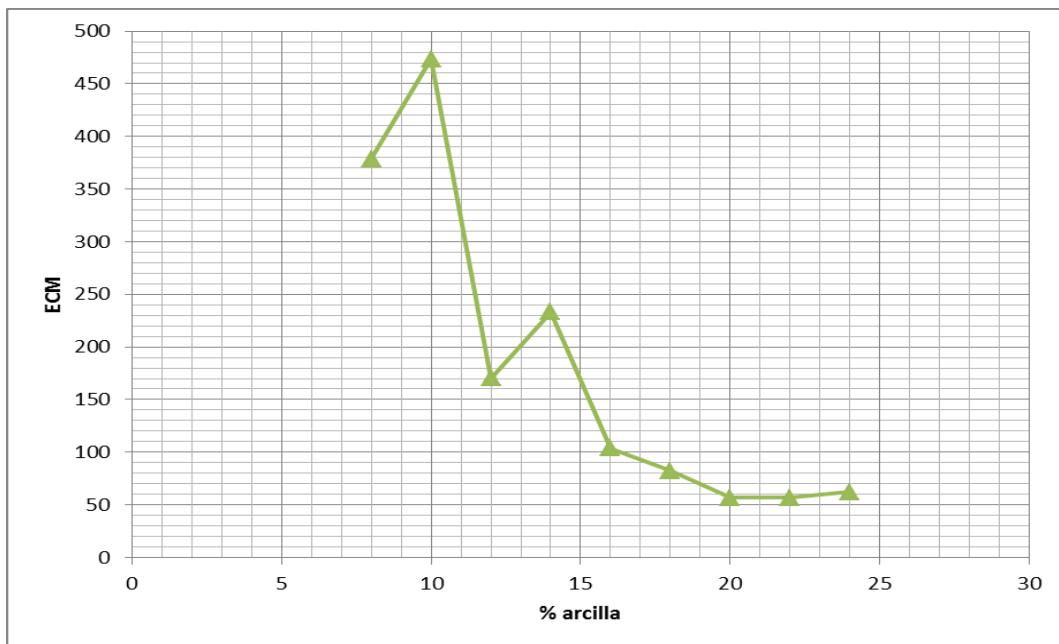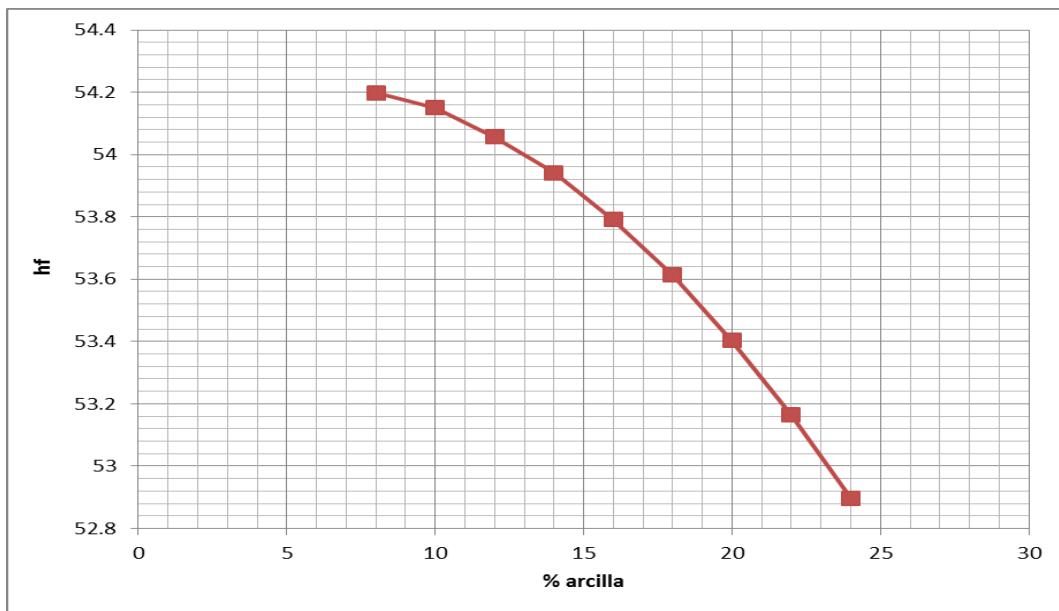
Ilustración 87.- Arcilla 17%-Arena 45%
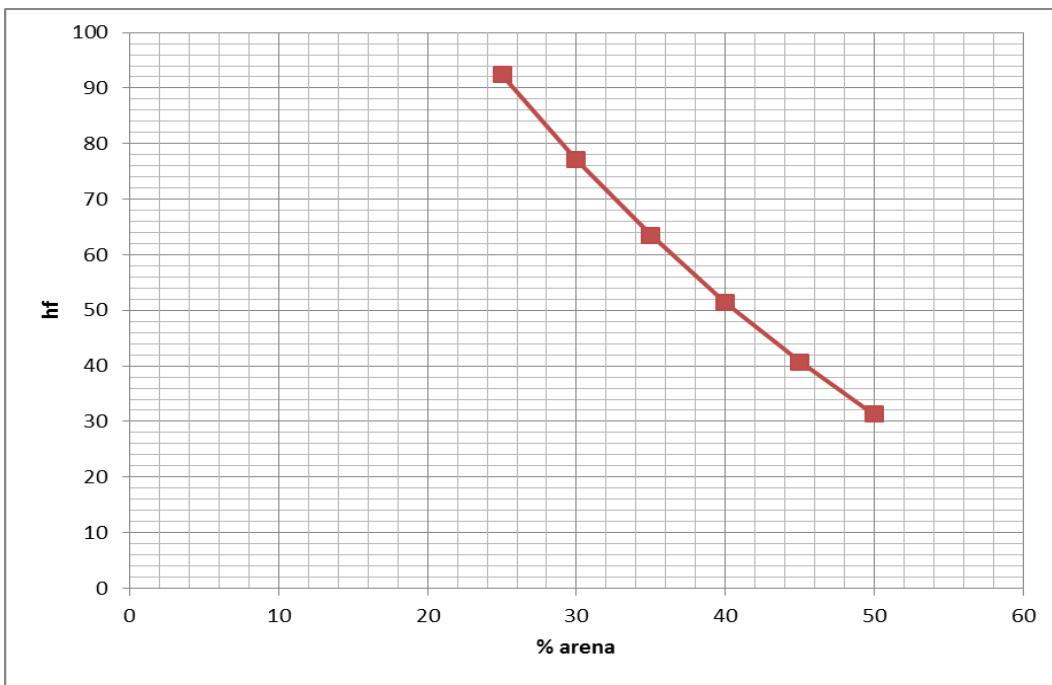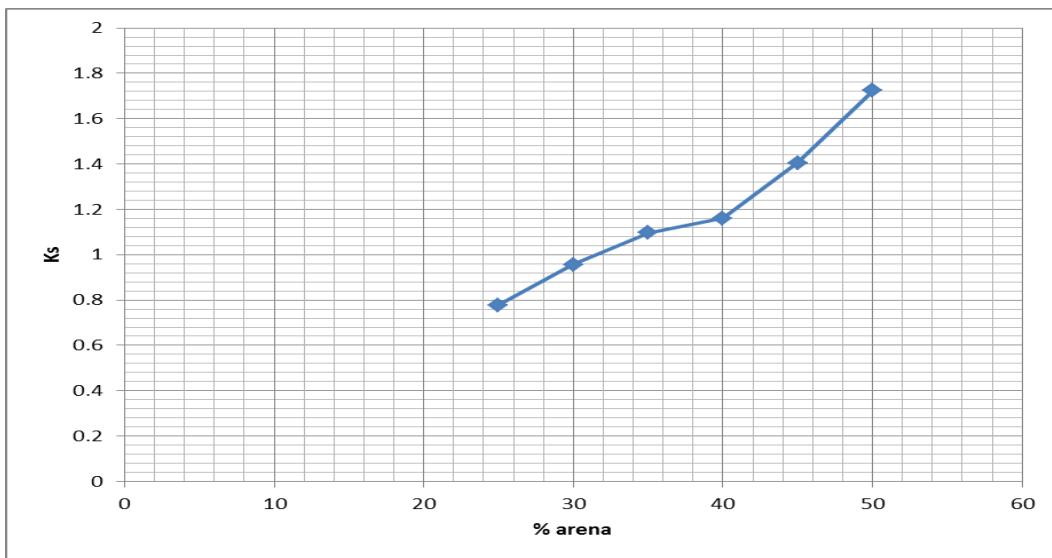
arcilla 17 % - arena 50%					
iteración	ECM	control ECM	Ks	var Ks	hf	var hf
1	112.606	0.988739	1.72104	-0.129116	31.3479	-0.00607495
2	59.4559	0.471999	1.72229	0.00124757	31.3479	1.25E-05
3	59.4559	0.001	1.7235	0.00121517	31.3479	1.34E-05
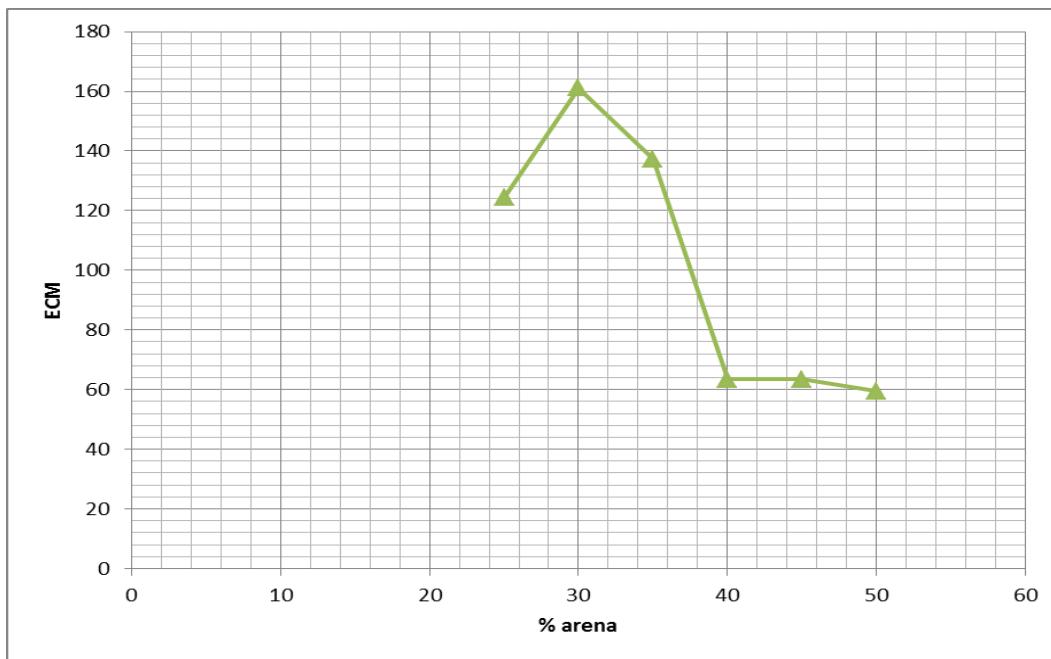
Ilustración 88.- Arcilla 17%-Arena 50%

4. Conclusiones

Se calibró y validó un software que permite: a) estimar parámetros de infiltración a partir de pruebas de avance de riego por melgas, y b) realizar el cálculo del gasto óptimo de riego a partir de datos de pruebas de avance y de la granulometría del suelo.

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