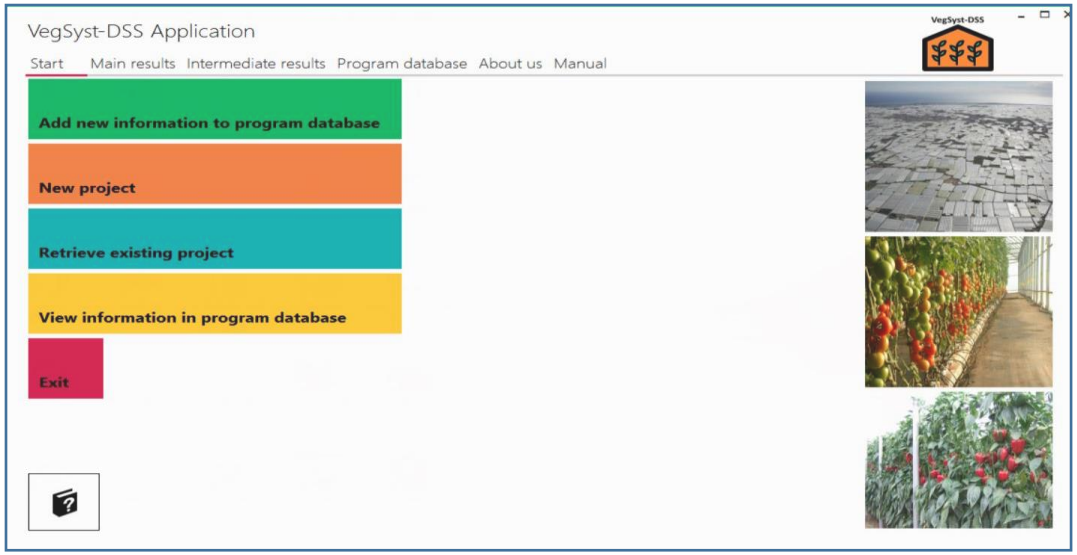
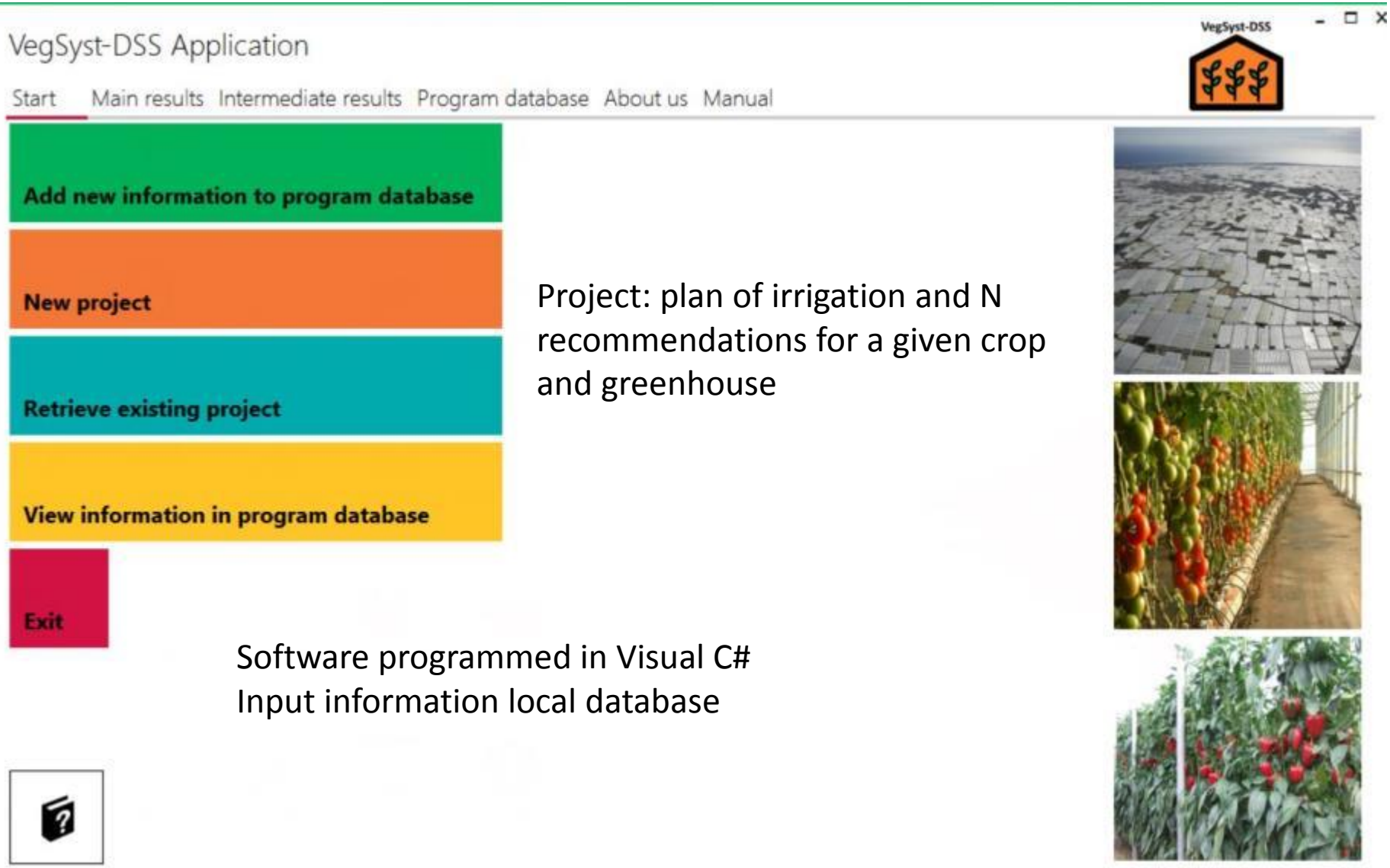


VegSyt-DSS: Tool to help the management of N fertilization in greenhouse vegetable crops

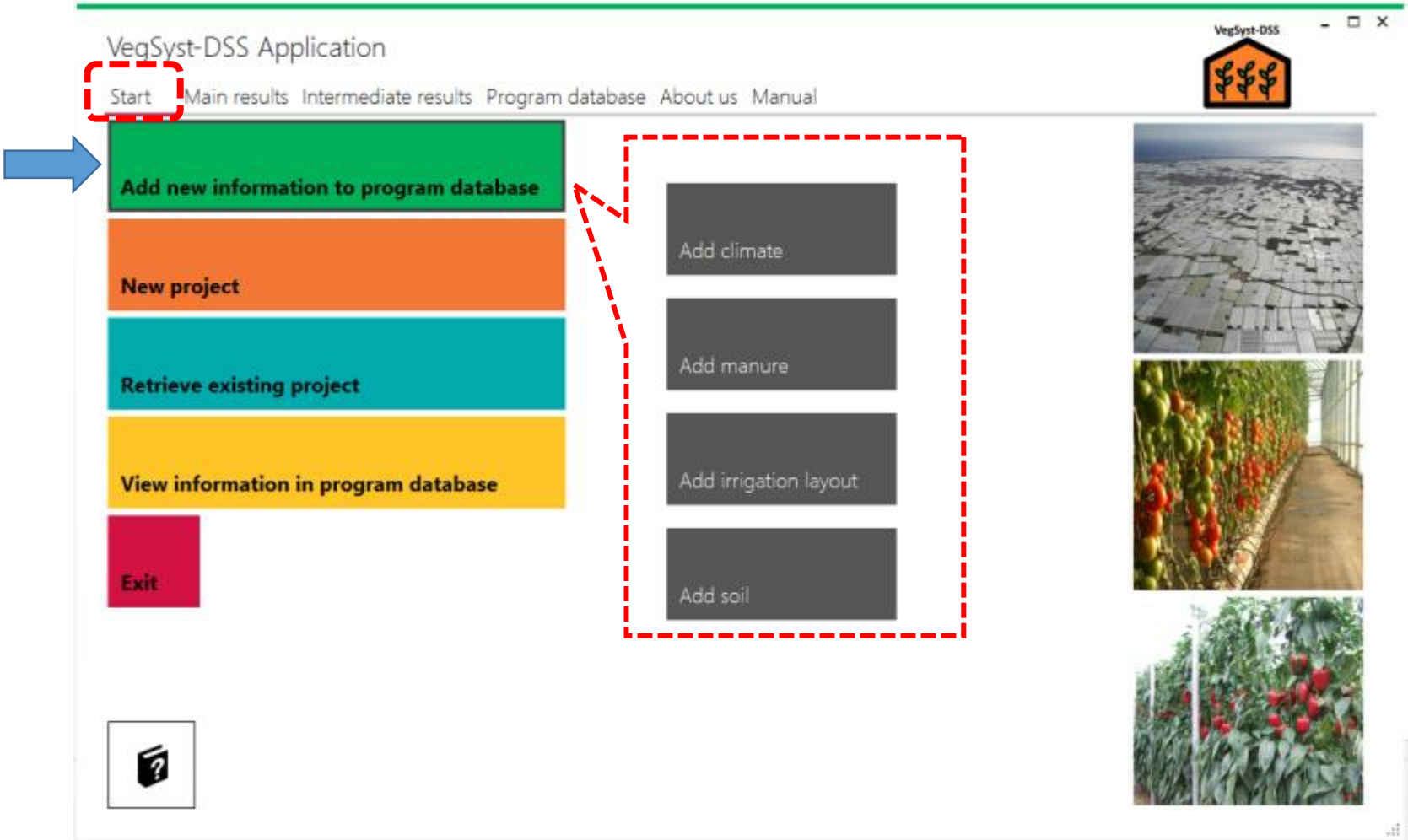
Marisa Gallardo
Departamento de Agronomía
Universidad de Almería

Presentation of the software



Project: plan of irrigation and N recommendations for a given crop and greenhouse

Software programmed in Visual C#
Input information local database


VegSyst-DSS Application
VegSyst-DSS
Start
Main results
Intermediate results
Program database
About us
Manual
Add new information to program database
New project
Retrieve existing project
View information in program database
Exit
Add climate
Add manure
Add irrigation layout
Add soil

Example of the use of VegSyst - DSS

Sweet pepper crop

- 15 July to 15 February
- Roof whitened until 15 sept
- 80 kg N ha^{-1} in soil at planting
- 50 m^3 ha^{-1} of manure applied six months before planting
- UC irrigation system 0.95
- EC of water: 2 dS m^{-1}

VegSyst-DSS Application

Start | Main results | Intermediate results | Program database | About us | Manual

Add new information to program database

New project

Retrieve existing project

View information in program database

Exit

New project

Name of project:
Pepper-Hortimodel

Size of greenhouse (m2):
1000

Select cropping media:
- (●) Soil
- ( ) Substrate

*** Climate:**
CAJAMAR-HISTORICAL

*** Soil:**
soil pepper

*** Irrigation layout:**
Single 1 x 0.5

Salinity:
Set salinity of irrigation water

Consider uniformity coefficient:
- (●) Yes 0.95
- ( ) No

Date of most recent manure application:
15 February 2015

Volume of manure applied (m3/ha):
50

Type of manure:
Standard Almeria sheep manure

Crop species:
PEPPER-REV

Planting method:
- (●) Transplanting
- ( ) Sowing

Transplanting/sowing date:
15 July 2015

End of crop
15 February 2016

****Soil mineral N: (kg N/ha)**
Soil mineral N at planting: ☐ Unknown
80

ETo Equation:
- ( ) FAO56 Penman-Monteith (fixed ra)
- (●) Almeria radiation

Whitening
☐ No whitening

Date of application
15 July 2015

Date of removal
15 September 2015

Transmissivity values
0.00

If not measured, select type of whitening:
( ) Light - 0.45 (●) Medium - 0.30 ( ) Severe - 0.20

Add | Remove

Date of application	Date of removal	Transmissivity
15/07/2015	15/09/2015	0.3

*** Add new information to database on start windows**
**** In the root zone (e.g. 0-30 cm soil depth)**

Save | Exit

VegSyst-DSS Application

Start | Main results | Intermediate results | Program database | About us | Manual

Add new information to program database

New project

Retrieve existing project

View information in program database

Exit

Retrieve existing project

Name of project

TOMATO-SOIL

Pepper-Hortimodel

VegSyst-DSS

Greenhouse name: Pepper-Hortimodel

Size (m2): 1000

Climate: CAJAMAR-HISTORICAL

Crop: PEPPER-REV

Cropping cycle	Whitening	Transmissivity
15/07/2015 - 15/02/2016	15/07/2015 - 15/09/2015	0.3

Cropping media

Soil: soil pepper **Soil mineral N at planting:** 80 (kg N/ha)

Soil bulk density (t/m3)	Effective rooting depth (m)	Soil organic N (%)	N mineralization rate per year (%)
1.4	0.3	0.08	1

Irrigation layout: Single line

Dripper flow rate (L/h)	Distance between lines (m)	Distance between drippers within lines (m)
3	1	0.5

Manure

Type	Date of application	Volume(m3/ha)
Standard Almeria sheep manure	15/02/2015	50

Salinity of water (dS/m): 2

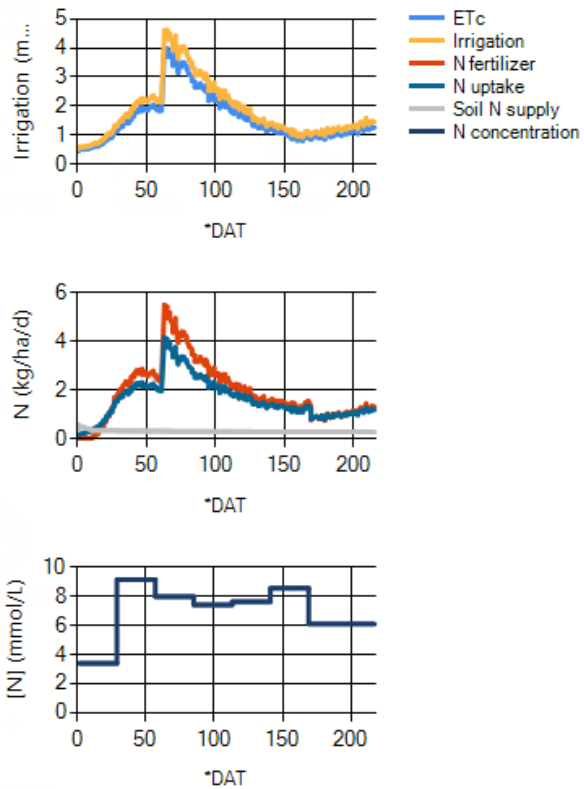
Uniformity coefficient irrigation system: 0.95

Ok Exit

VegSyst-DSS Application

Start | Main results | Intermediate results | Program database | About us | Manual

Export report to EXCEL



Daily values during the crop

Day after transplanting	Irrigation volume (mm)	Irrigation time (min)	N fertilizer (Kg/ha)	N Concentration (mmol/L)
1	0.00	0.00	0.00	0.00
2	0.51	5.12	0.00	0.00
3	0.59	5.90	0.00	0.00
4	0.60	6.00	0.00	0.00
5	0.59	5.94	0.00	0.00
6	0.59	5.89	0.00	0.00
7	0.61	6.09	0.00	0.00
8	0.62	6.15	0.00	0.00
9	0.60	6.05	0.00	0.00
10	0.63	6.29	0.00	0.00
11	0.66	6.55	0.00	0.00
12	0.67	6.65	0.02	0.17
13	0.68	6.76	0.05	0.56
14	0.73	7.29	0.13	1.25
15	0.73	7.26	0.16	1.58
16	0.70	7.05	0.18	1.80
17	0.74	7.38	0.25	2.39

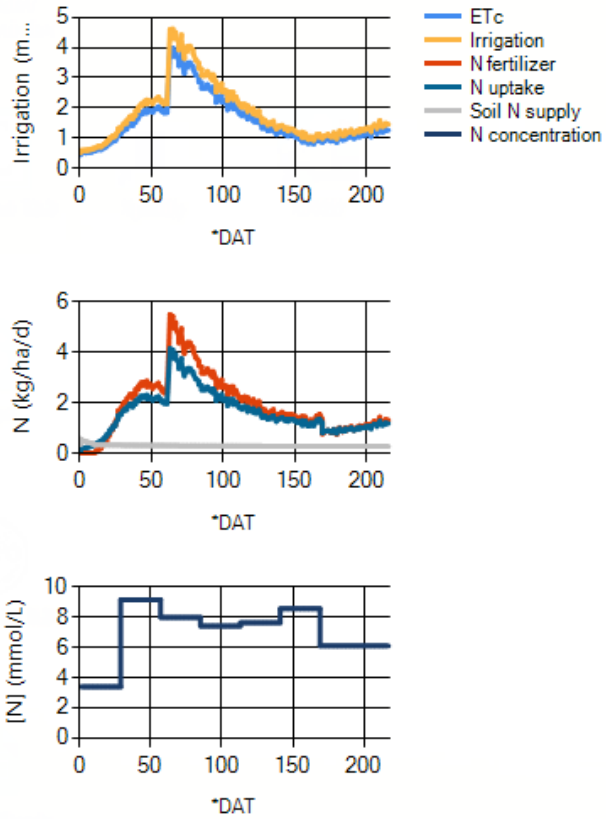
***Day after transplanting**

VegSyst-DSS Application

Start | Main results | Intermediate results | Program database | About us | Manual

VegSyst-DSS

Export report to EXCEL



Daily values during the crop

Day transp			N fertilizer (Kg/ha)	N Concentration (mmol/L)
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.00	0.00
			0.02	0.17
			0.05	0.56
			0.13	1.25
			0.16	1.58
			0.18	1.80
17	0.74	7.38	0.25	2.39

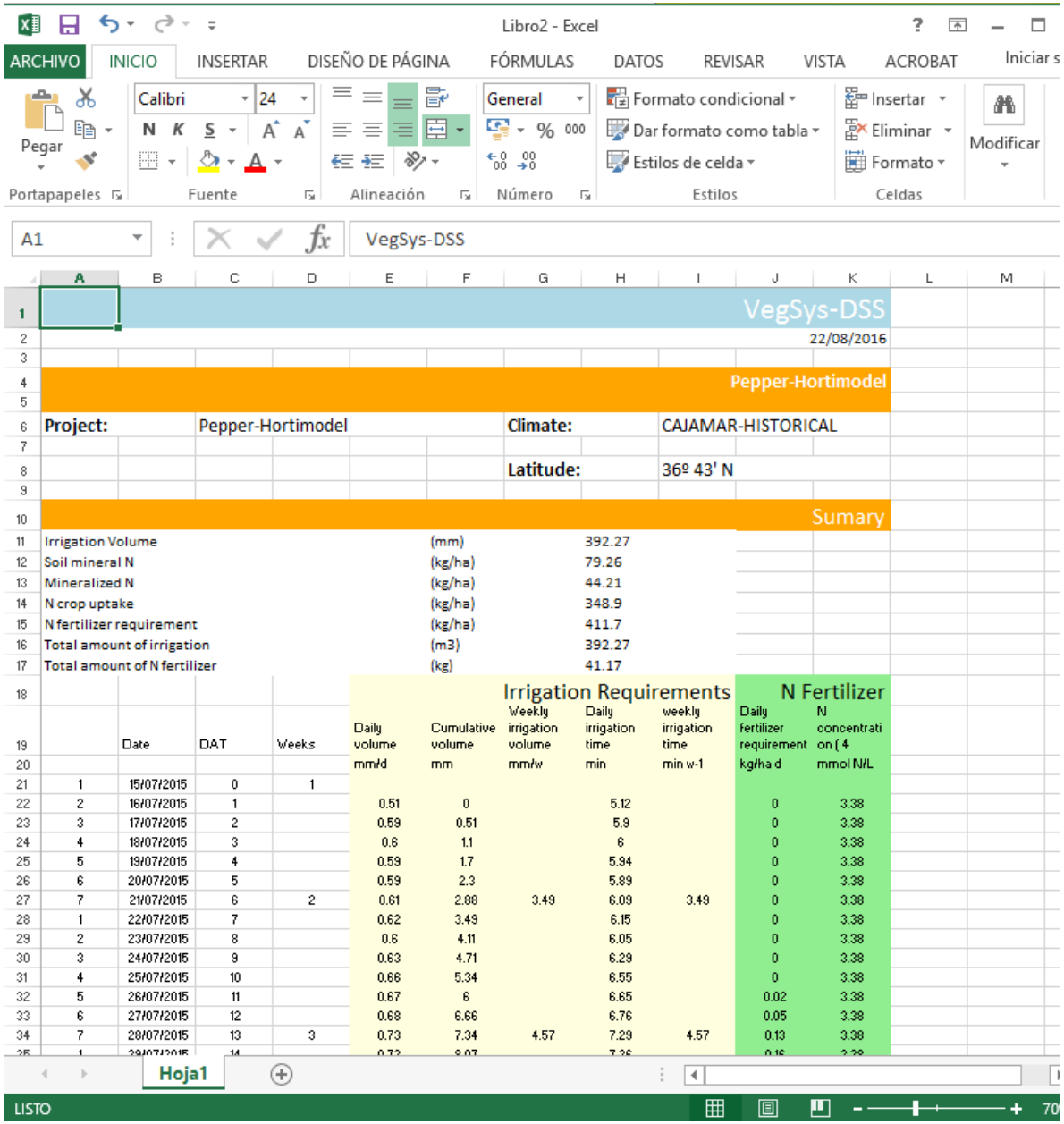
*Day after transplanting

Option selection

- **Short excel report**
  - Irrigation requirements
  - N fertilizer
- **Detailed excel report**
  - Irrigation requirements
  - N uptake
  - N sources
  - Fertilizer requirements

Report | Cancel

Short Excel report



VegSys-DSS

22/08/2016

Pepper-Hortimodel

Project: Pepper-Hortimodel **Climate:** CAJAMAR-HISTORICAL

Latitude: 36º 43' N

Sumary

Irrigation Volume	(mm)	392.27
Soil mineral N	(kg/ha)	79.26
Mineralized N	(kg/ha)	44.21
N crop uptake	(kg/ha)	348.9
N fertilizer requirement	(kg/ha)	411.7
Total amount of irrigation	(m3)	392.27
Total amount of N fertilizer	(kg)	41.17

				Irrigation Requirements					N Fertilizer	
	Date	DAT	Weeks	Daily volume	Cumulative volume	Weekly irrigation volume	Daily irrigation time	weekly irrigation time	Daily fertilizer requirement	N concentration (4
				mm/d	mm	mm/w	min	min w-1	kg/ha d	mmol N/L
1	15/07/2015	0	1							
2	16/07/2015	1		0.51	0		5.12		0	3.38
3	17/07/2015	2		0.59	0.51		5.9		0	3.38
4	18/07/2015	3		0.6	1.1		6		0	3.38
5	19/07/2015	4		0.59	1.7		5.94		0	3.38
6	20/07/2015	5		0.59	2.3		5.89		0	3.38
7	21/07/2015	6	2	0.61	2.88	3.49	6.09	3.49	0	3.38
1	22/07/2015	7		0.62	3.49		6.15		0	3.38
2	23/07/2015	8		0.6	4.11		6.05		0	3.38
3	24/07/2015	9		0.63	4.71		6.29		0	3.38
4	25/07/2015	10		0.66	5.34		6.55		0	3.38
5	26/07/2015	11		0.67	6		6.65		0.02	3.38
6	27/07/2015	12		0.68	6.66		6.76		0.05	3.38
7	28/07/2015	13	3	0.73	7.34	4.57	7.29	4.57	0.13	3.38

Irrigation requirements

- Irrig. volume
- Irrig. time

N Fertilizer

-N requirements (daily)
-N concentration (4-weeks)

Detailed report – daily values

Irrigation requirements

ETo - Irrig. volume
Kc - Irrig. time
ETc - Weekly irrig.

N uptake

- Daily crop N uptake
- Seasonal N uptake

N sources

- Soil mi. N
- Mineralized N
- Total Net N supply

N requirements

- N requirements (daily, cumulative and weekly)
- N concentration (weekly and 4-weeks)

VegSys-DSS

07/05/2017

Pepper-Hortimodel

Project:	Pepper-Hortimodel	Climate:	CAJAMAR-HISTORICAL
		Latitude:	36º 43' N

Sumary

rrigation Volume	(mm)	392.27
oil mineral N	(kg/ha)	79.26
Mineralized N	(kg/ha)	44.21
crop uptake	(kg/ha)	348.9
fertilizer requirement	(kg/ha)	411.7
otal amount of irrigation	(m3)	392.27
otal amount of N fertilizer	(kg)	41.17

				IRRIGATION REQUIREMENTS								N UPTAKE		N SOURCES					FERTILIZER REQUIREMENTS				
	Date	DAT	Weeks	ETo (mm/d)	kc	ETc (mm/d)	Daily volume (mm/d)	Cumulative volume (mm)	Weekly irrigation volume (mm/w)	Daily irrigation time (min)	weekly irrigation time (min/w)	Daily crop N uptake (kg/ha/d)	Cumulative crop N uptake (kg N)	Daily soil mineral N (kg/ha/d)	Cumulative soil mineral N (kg/ha)	Mineralized N (daily) (kg/ha/d)	Mineralized N (cumulative) (kg/ha)	Total Net N supply (kg/ha/d)	Daily N fertilizer requirements (kg/ha/d)	Cumulative N fertilizer requirements (kg/ha)	Weekly fertilizer requirements (kg/ha)	Weekly N concentration (mmol N/L)	Average four weekly N concentration (mmol N/L)
1	15/07/2015	0	1																				
2	16/07/2015	1		2	0.22	0.44	0.51	0		5.12		0.1	0.1	0.3687	0.3687	0.2896	0.2896	0.3291	0	0			3.38
3	17/07/2015	2		2.14	0.24	0.51	0.59	0.51		5.9		0.19	0.28	0.3687	0.7373	0.2882	0.5778	0.5598	0	0			3.38
4	18/07/2015	3		2.15	0.24	0.52	0.6	1.1		6		0.2	0.48	0.3687	1.106	0.2869	0.8647	0.4694	0	0			3.38
5	19/07/2015	4		2.11	0.24	0.51	0.59	1.7		5.94		0.21	0.69	0.3687	1.4747	0.2856	1.1503	0.4567	0	0			3.38
6	20/07/2015	5		2.07	0.25	0.51	0.59	2.3		5.89		0.21	0.9	0.3687	1.8433	0.2843	1.4346	0.4478	0	0			3.38
7	21/07/2015	6	2	2.11	0.25	0.53	0.61	2.88	3.49	6.09	34.94	0.23	1.14	0.3687	2.212	0.283	1.7176	0.4382	0	0	0	0	3.38
1	22/07/2015	7		2.11	0.25	0.53	0.62	3.49		6.15		0.25	1.38	0.3687	2.5806	0.2817	1.9993	0.4184	0	0			3.38
2	23/07/2015	8		2.04	0.26	0.52	0.6	4.11		6.05		0.26	1.64	0.3687	2.9493	0.2804	2.2797	0.4022	0	0			3.38
3	24/07/2015	9		2.08	0.26	0.54	0.63	4.71		6.29		0.28	1.92	0.3687	3.318	0.2792	2.5589	0.3921	0	0			3.38
4	25/07/2015	10		2.13	0.27	0.57	0.66	5.34		6.55		0.31	2.23	0.3687	3.6866	0.2779	2.8368	0.3656	0	0			3.38
5	26/07/2015	11		2.12	0.27	0.57	0.67	6		6.65		0.33	2.56	0.3687	4.0553	0.2767	3.1136	0.3355	0.02	0.02			3.38
6	27/07/2015	12		2.11	0.28	0.58	0.68	6.66		6.76		0.36	2.92	0.3687	4.424	0.2755	3.3891	0.3221	0.05	0.07			3.38
7	28/07/2015	13	3	2.22	0.28	0.63	0.73	7.34	4.57	7.29	45.75	0.41	3.33	0.3687	4.7926	0.2743	3.6634	0.3215	0.13	0.2	0.2	0.31	3.38
1	29/07/2015	14		2.15	0.29	0.63	0.73	8.07		7.26		0.43	3.77	0.3687	5.1613	0.2731	3.9365	0.3209	0.16	0.36			3.38
2	30/07/2015	15		2.02	0.3	0.61	0.7	8.79		7.05		0.44	4.21	0.3687	5.53	0.272	4.2085	0.3203	0.18	0.53			3.38
3	31/07/2015	16		2.06	0.31	0.64	0.74	9.5		7.38		0.49	4.7	0.3687	5.8986	0.2708	4.4793	0.3197	0.25	0.78			3.38
4	01/08/2015	17		2.08	0.32	0.67	0.77	10.24		7.75		0.55	5.25	0.3687	6.2673	0.2696	4.7489	0.3192	0.32	1.11			3.38
5	02/08/2015	18		2.08	0.33	0.69	0.8	11.01		8.01		0.6	5.85	0.3687	6.6359	0.2685	5.0174	0.3186	0.4	1.5			3.38

VegSyst-DSS Application

Start | Main results | Intermediate results | Program database | About us | Manual

VegSyst-DSS

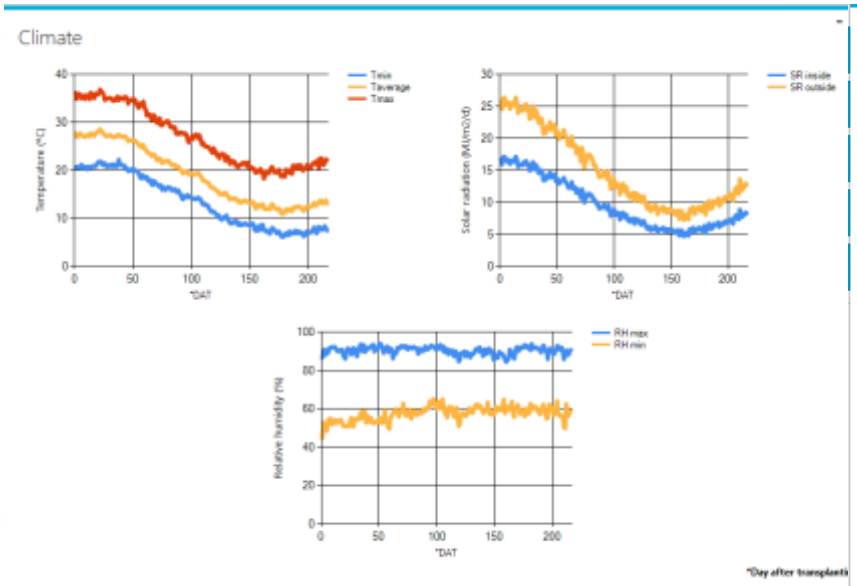
Irrigation parameters
- ETo
- kc
- ETc
- Daily irrigation
- Leaching fraction

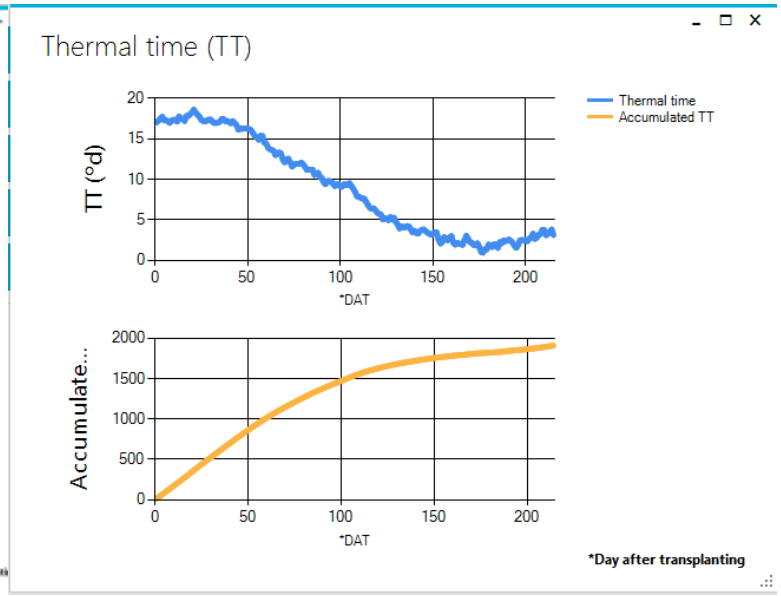
N sources
- Soil mineral N at planti...
- Manure N applied
- Mineralized N
- N supply from soil

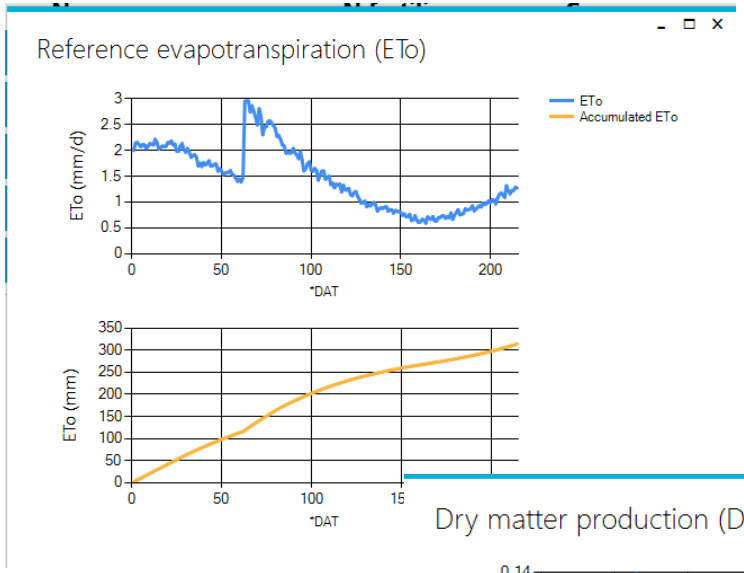
N fertilizer
- N Fertilizer

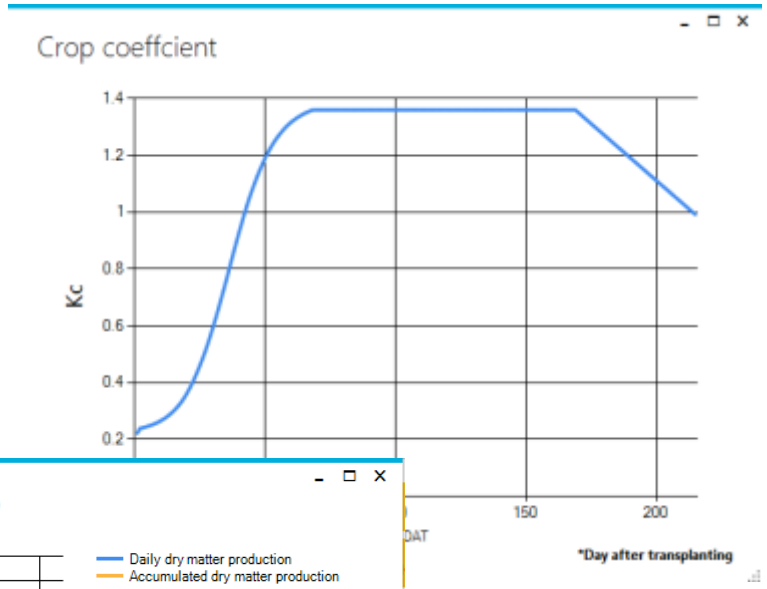
Crop
- Crop details
- Dry matter producti...
- Crop N uptake

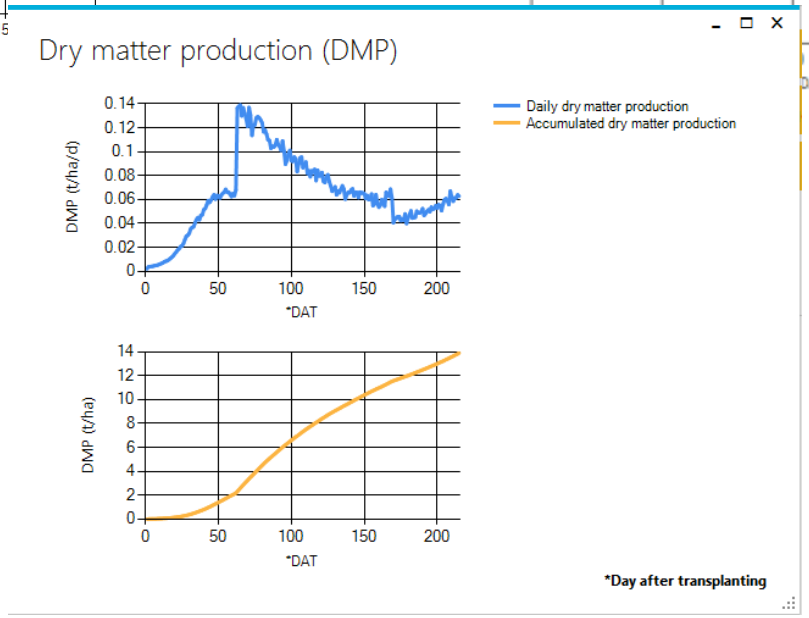
Climate
- Climate
- Thermal time



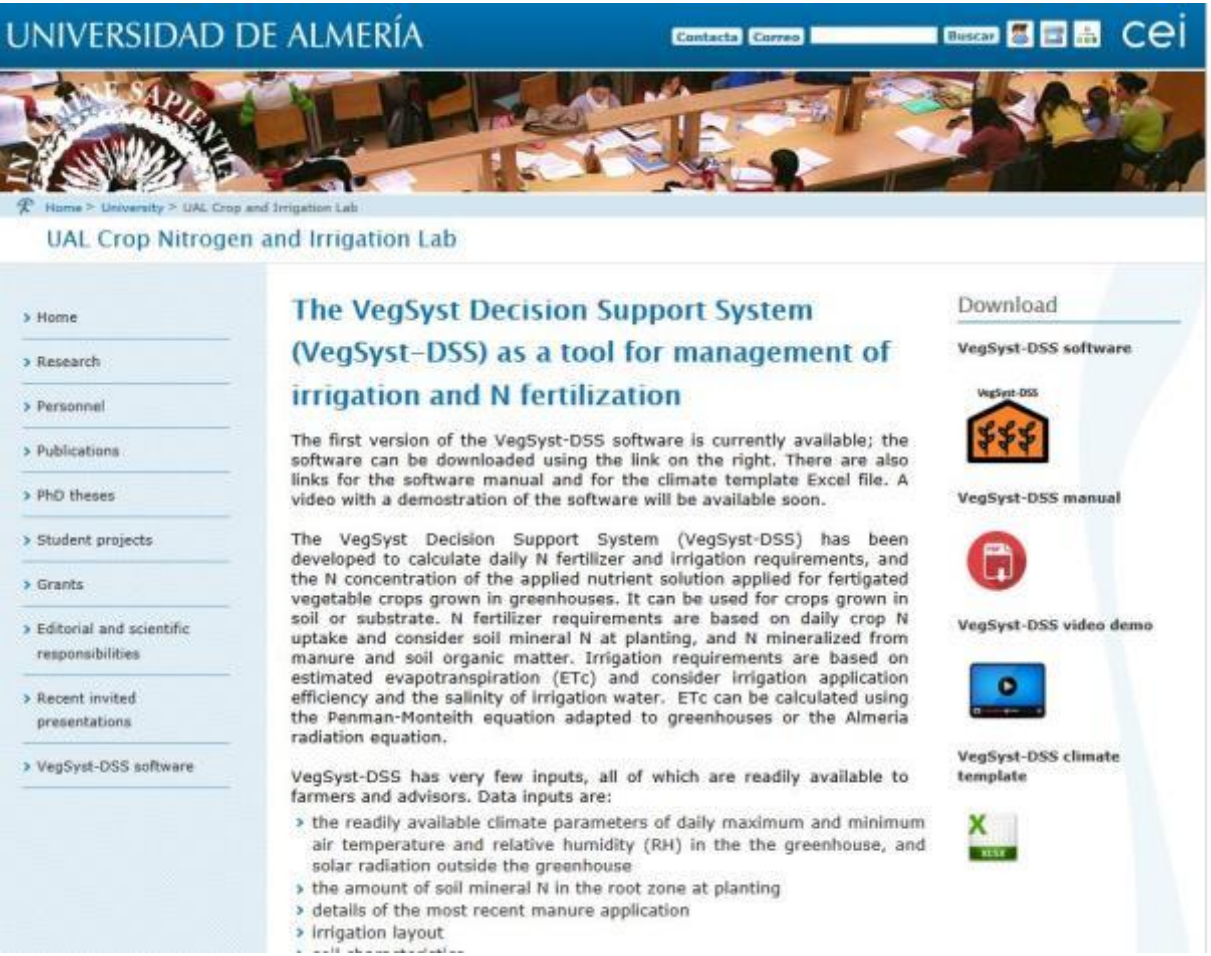



Reference evapotranspiration (ETo)
ETo
Accumulated ETo
ETo (mm/d)
*DAT
ETo (mm)
*DAT


Crop coeffcient
Kc
*Day after transplanting


Dry matter production (DMP)
Daily dry matter production
Accumulated dry matter production
DMP (t/ha/d)
*DAT
DMP (t/ha)
*DAT
*Day after transplanting

Further Information



The software and a manual can be freely downloaded at http://www.ual.es/GruposInv/nitrogeno/index.shtml

Additionally, a video demonstration is available on this web page

For information about this DSS, comments or help in using it, please contact M. Gallardo, Department of Agronomy, University of Almeria, 04120 Almeria, Spain **mgallard@ual**

Thanks !!