

# SWAT+ Workshop

## Management in SWAT+

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Celray James CHAWANDA  
celray.chawanda@vub.be

Management  
in SWAT+

- a) Management schedules
- b) Decision tables

# Management Schedules

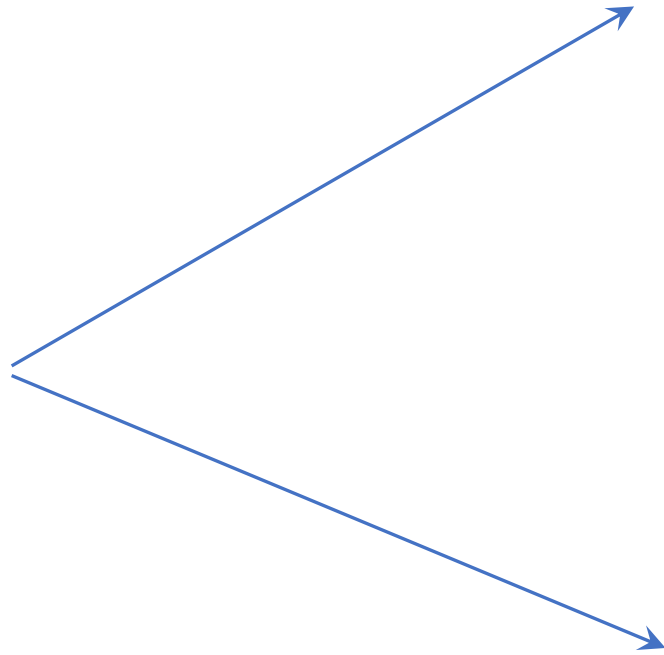
What are they?

Schedule of operations with fixed times within the year.

- Planting
- Fertilisation
- Harvesting
- Irrigation

management.sch: written by SWAT+ editor v1.2.3 on 2020-05-31 23:07

name	numb_ops	numb_auto	op_typ	mon	day	hu_sch	op_data1	op_data2	op_data3
agrl_rot	6	0							
			plnt	3	1	0.0000	agrl	null	0.0000
			fert	3	30	0.0000	elem-n	broadcast	150.000
			fert	4	30	0.0000	elem-p	broadcast	20.000
			harv	7	1	0.0000	agrl	grain	0.0000
			kill	7	1	0.0000	agrl	null	0.0000
			skip	0	0	0.0000	null	null	0.0000



Irrigate

Do not Irrigate

# Decision tables

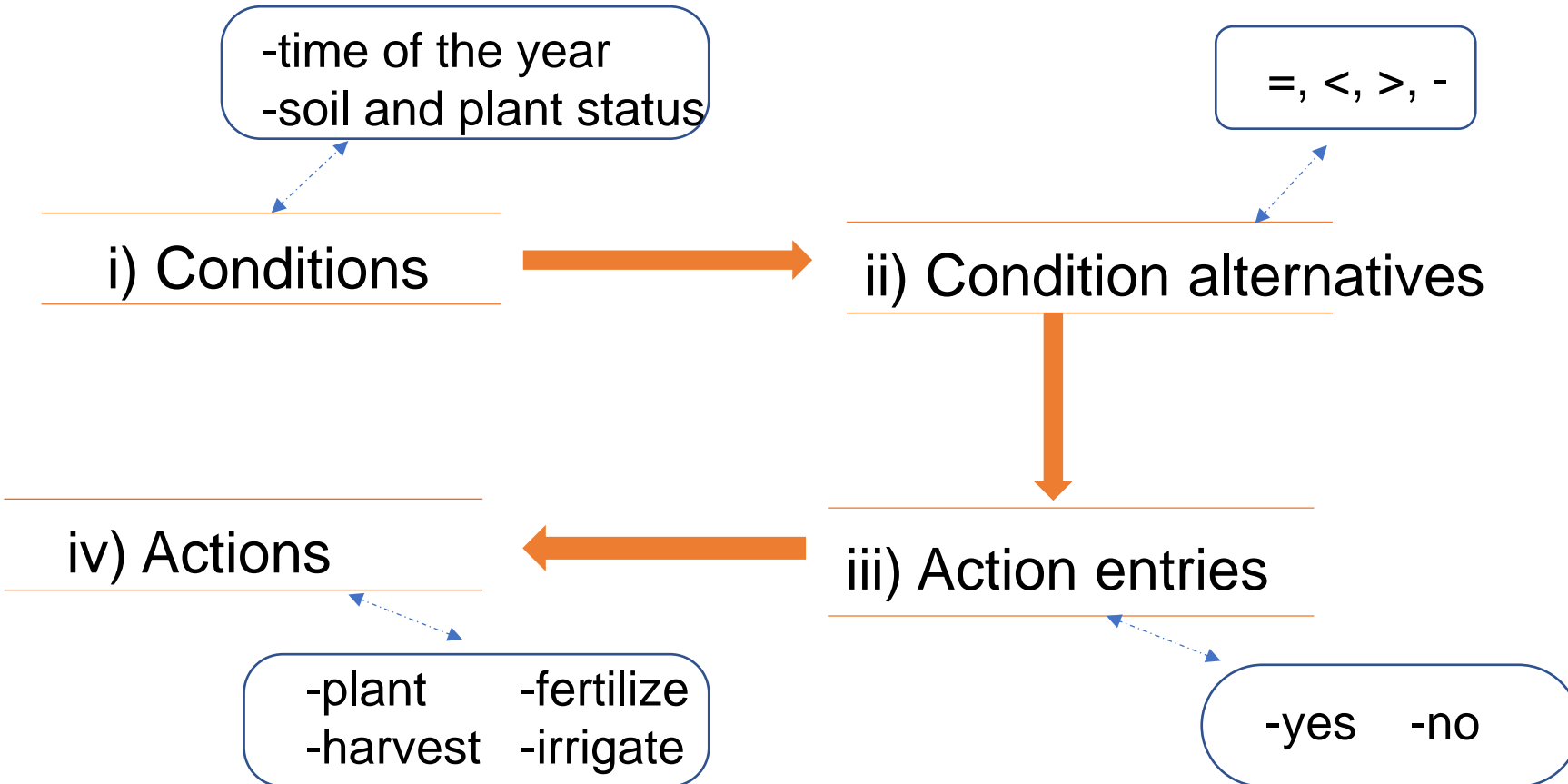
## What are they?

- Decision tables list conditions which must be fulfilled for an action to be performed within the model

<b>CONDITIONS</b>	<b>ALTERNATIVES</b>
<b>ACTIONS</b>	<b>ACTION ENTRIES</b>

- Precise, compact way to model complex rule sets and their corresponding actions

# Decision tables – How do they work?



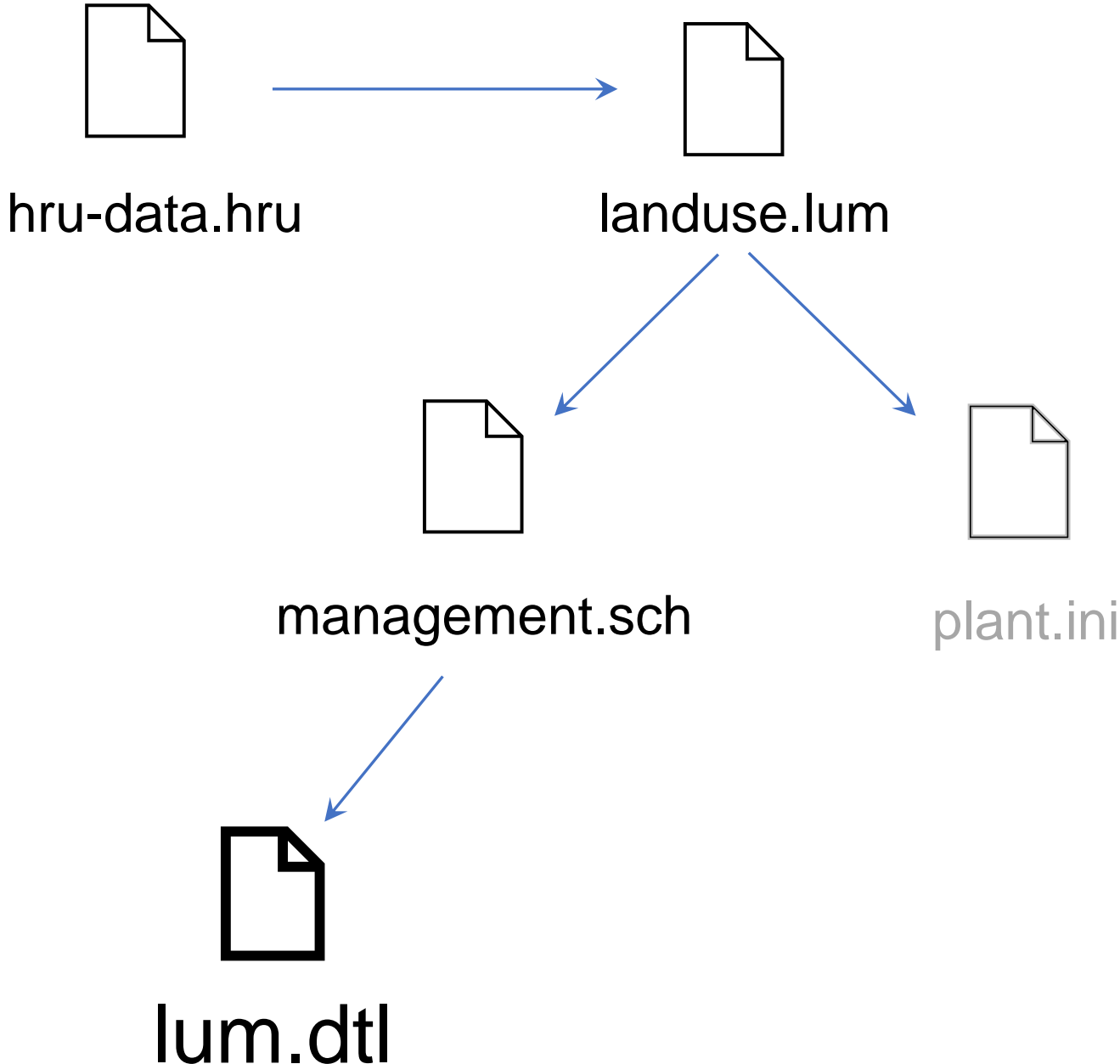
# Decision tables

## Irrigation Example

Name	Conds	Alts	Acts					
irr_corn	1	1	1					
var	obj	obj_num	lim_var	lim_op	lim_const		alt1	
soil_water	hru	5	fc	*	0.8		<	
act_typ	obj	obj_num	name	option	const	const2	fp	outcome
irrigate	aqu	1	furrow_irr	furrow	20.0	0.0	null	y

IF Soil Water in HRU 5 is less than 80% of field capacity then Irrigate 20mm using furrow method from aqu

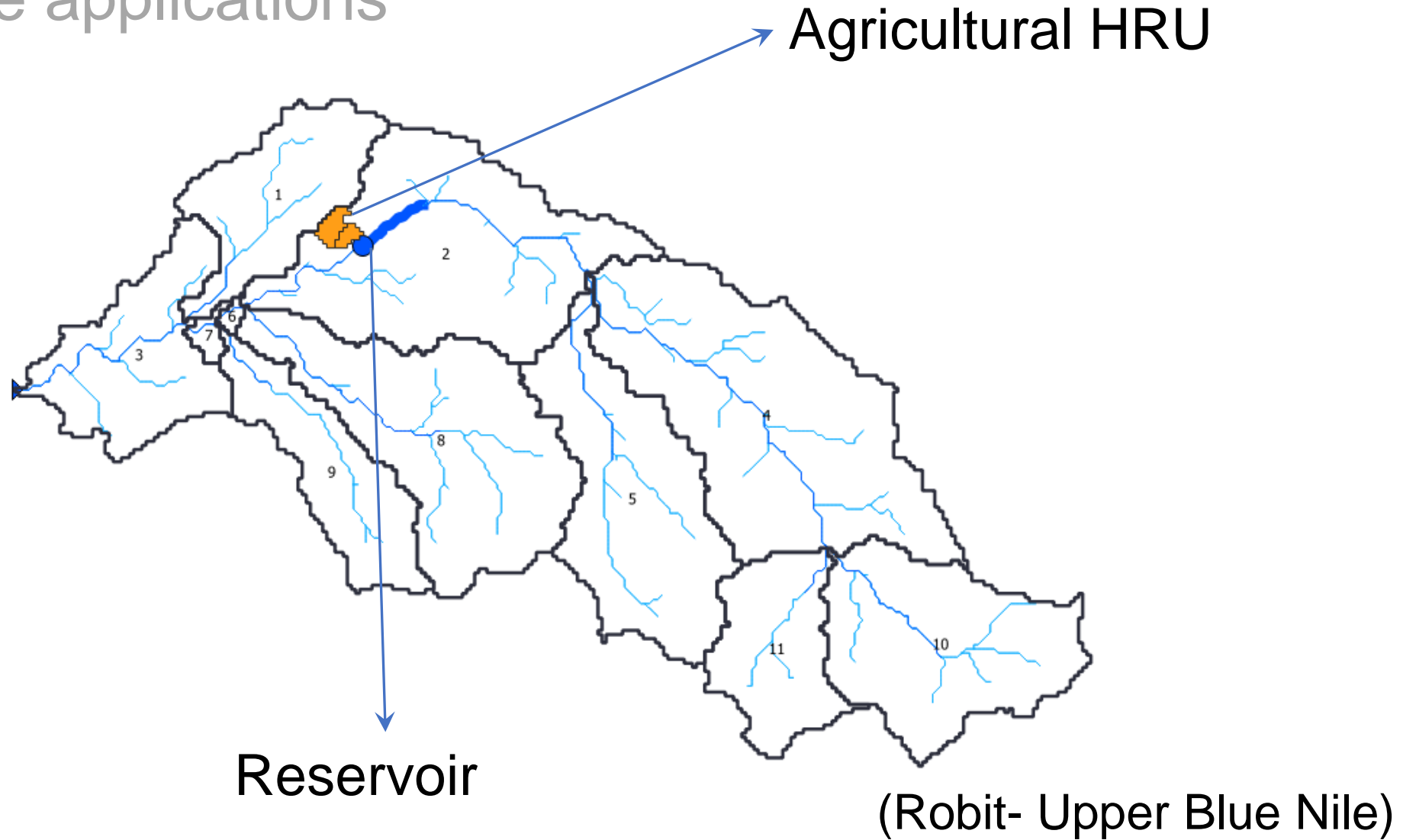
# Management in SWAT+





# Decision tables

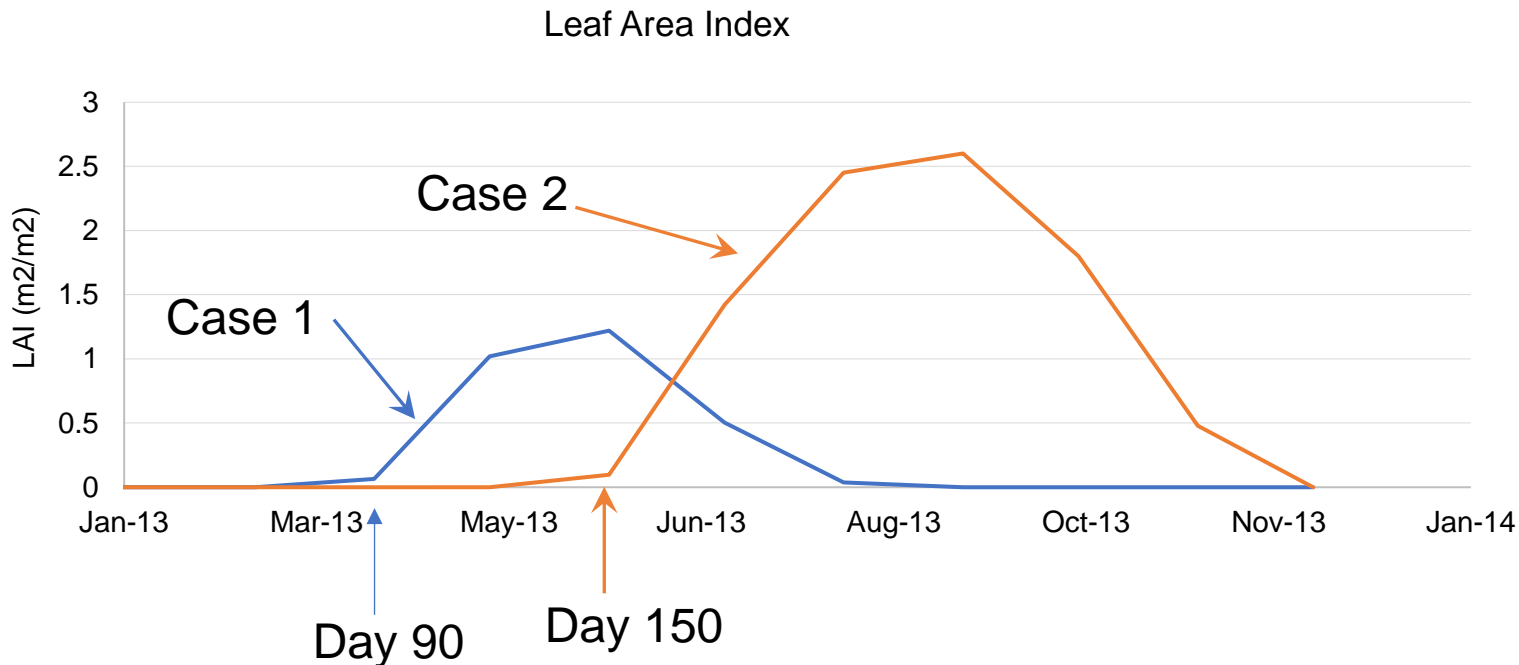
Some applications



# Decision tables

## Some applications – Planting and Harvesting

name	conds	alts	acts	lim_op	lim_const	alt1	alt2	
pl_hv_agrl	2	2	2	-	90.00000	=	-	
var	obj	obj_num	lim_var	-	220.00000	-	=	
act_typ	obj	obj_num	name	option	const	const2	fp	outcome
plant	hru	0	plant_agrl	agrl	0.00000	1.00000	null	y n
harvest_kill	hru	0	grain_harv	agrl	0.00000	1.00000	grain	n y



Crop/plant

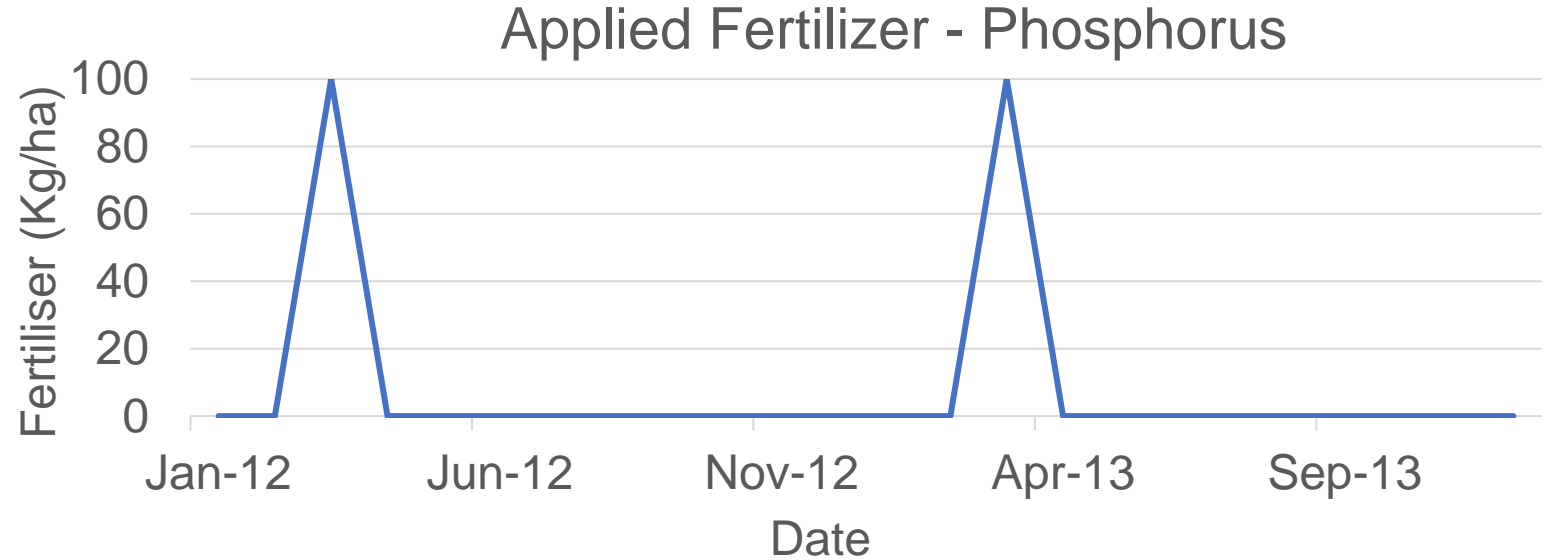
alternatives

Case 1  
Plant - day 90  
Harvest - day 220

Case 2  
Plant - day 150  
Harvest - day 330

# Decision tables

## Some applications - Fertilization



Condition variable

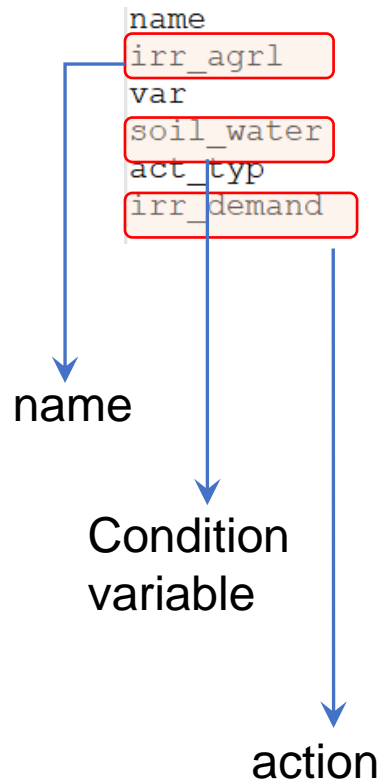
name

action

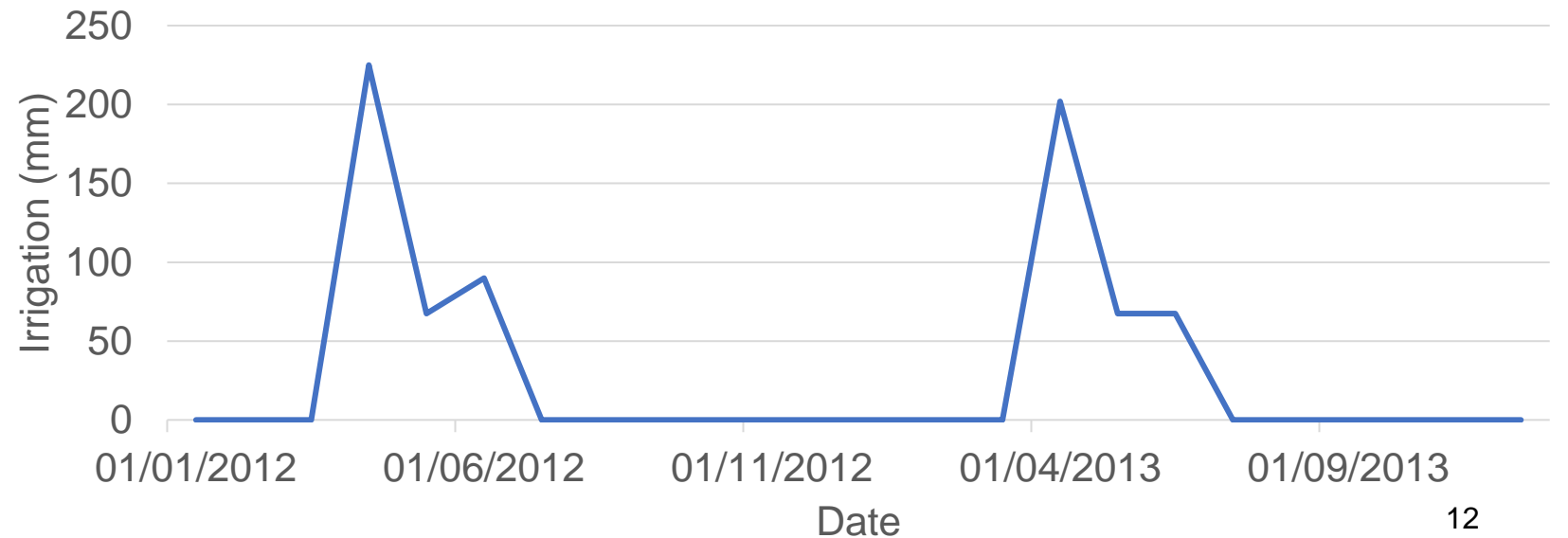
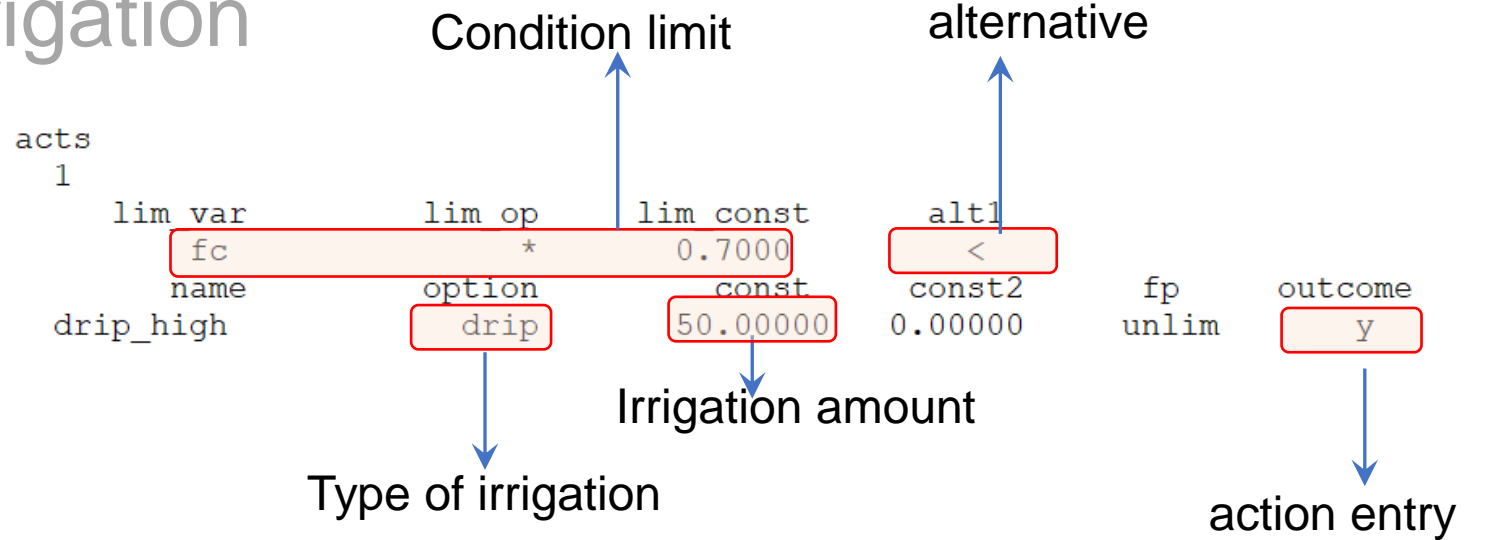
name	conds	alts	acts	Fertilizer type	Condition limit	alternative	action entry
fert_agrl	1	1	2				
var	obj	obj_num	lim_var	lim_op	lim_const	alt1	
jday	hru	0	null	-	90.00000	=	
act_typ	obj	obj_num	name	option	const	const2	fp
fertilize	hru	0	elemental_n	elem_n	180.00000	1.00000	inject
fertilize	hru	0	elemental_p	elem_p	100.00000	1.00000	broadcast
							outcome
							y
							y

# Decision tables

## Some applications – Irrigation



conds	1	alts	1
	obj	obj_num	0
	hru	obj_num	0
	obj	obj_num	0
	hru	obj_num	0



# Can you mix Decision tables with management schedules

Yes!

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name	numb_ops	numb_auto	op_typ	mon	day	hu_sch	op_data1	op_data2	op_data3
agrl_rot	4	2							
			fert_agrl						
			irr_agrl						
			plnt	3	1	0.0000	agrl	null	0.0000
			harv	7	1	0.0000	agrl	grain	0.0000
			kill	7	1	0.0000	agrl	null	0.0000
			skip	0	0	0.0000	null	null	0.0000

# In Summary

There are two ways to manage activities in SWAT+

Management Schedules are best for operations with fixed time

Decision tables are used to carry out activities when specified conditions are met

# Important Resources

SWAT+ Website

<https://swat.tamu.edu/software/plus/>

Use of Decision Tables to Simulate  
Management in SWAT+ (Arnold et. al., 2018)

# Exercise 1

In the robit project you set up.

Check ET

Implement Planting and Harvesting on 1<sup>st</sup> and 140<sup>th</sup> days respectively in agricultural land

Check water stress days and try to explain it

Check nitrogen stress in agricultural area

Check ET and explain if there are any changes



# Exercise 2

Implement drip irrigation (7mm per event) if crop is growing and moisture falls below 50% of field capacity (maximum irrigation events = 20)

Check ET again and explain if there are any changes

Check water stress days and nitrogen Stress days in Agricultural land

How much irrigation is applied in Agricultural land?

What do you notice about the pattern of irrigation?

# Exercise 3

Implement fertilizer application (urea – broadcasting)  
150kg/ha on 5<sup>th</sup> and 100<sup>th</sup> days of the year

Check ET again and explain if there are any changes

Check water stress days and nitrogen Stress days in Agricultural land?