Pecan tree irrigation-fertilization management model

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Pecan water and fertilizer use

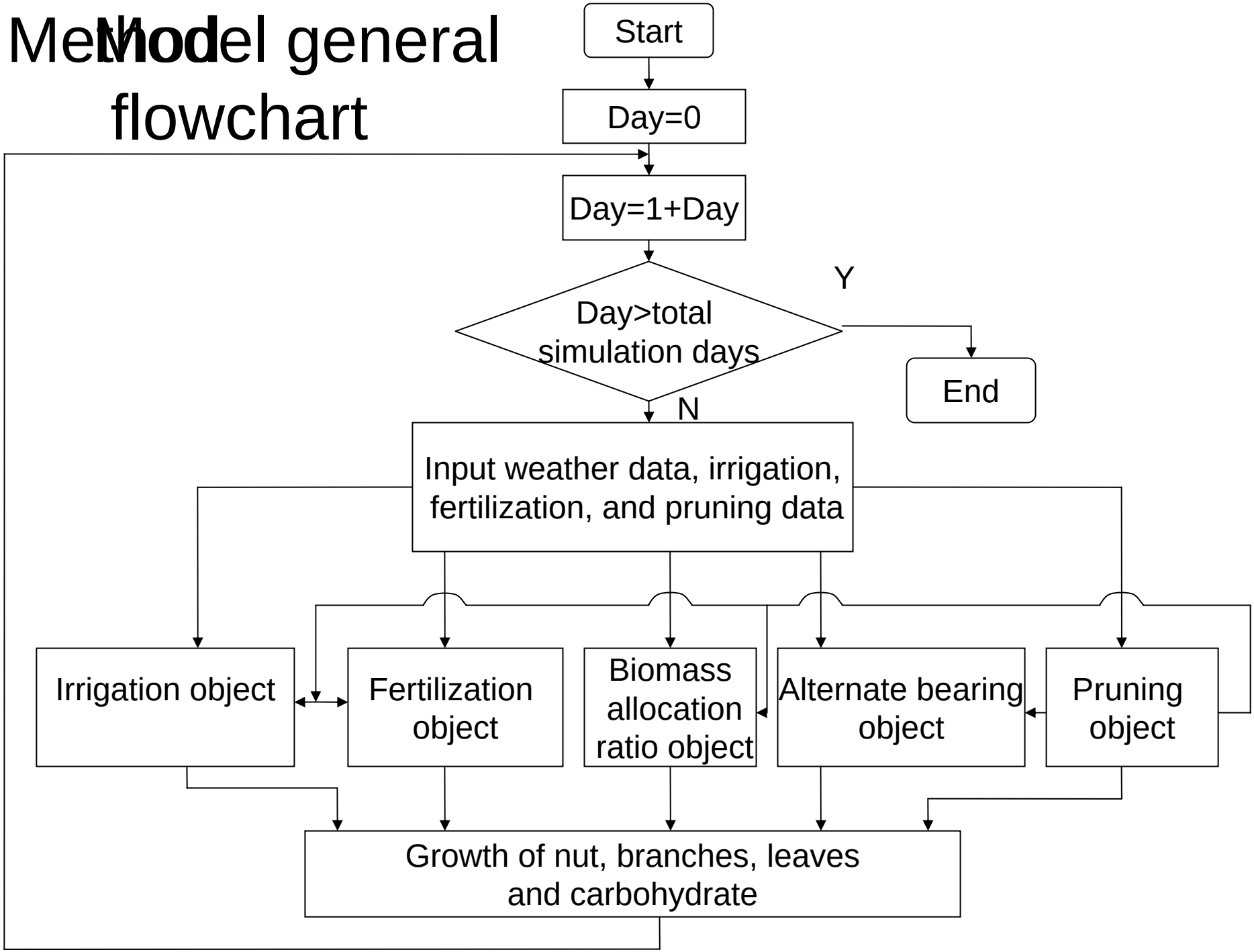
- Pecan ET can be 1.4 m a year, and irrigation is about 2 m.

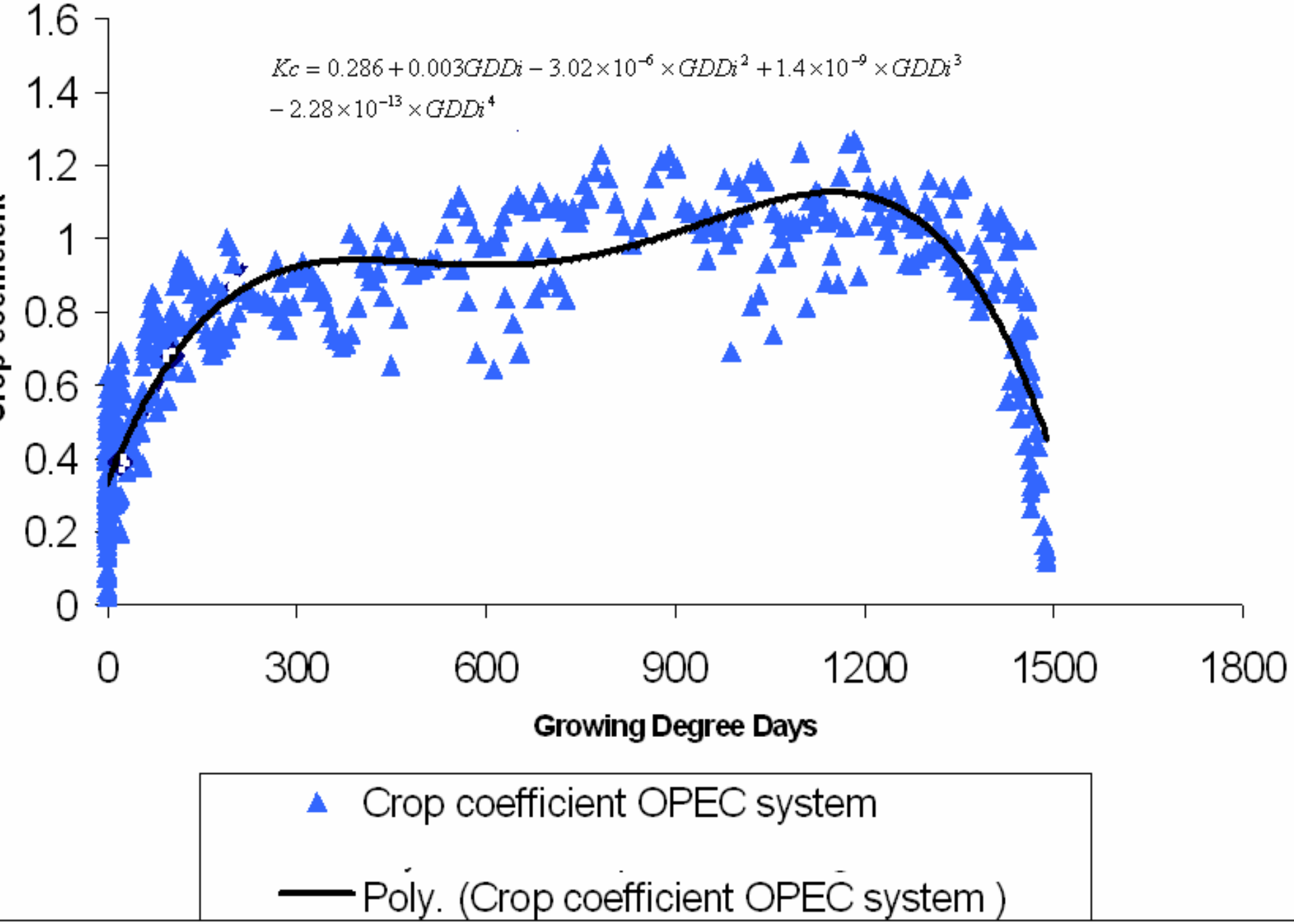
- Annual nitrogen use is about 200 kg/ha (100 trees), and fertilization is about 350 N kg/ha

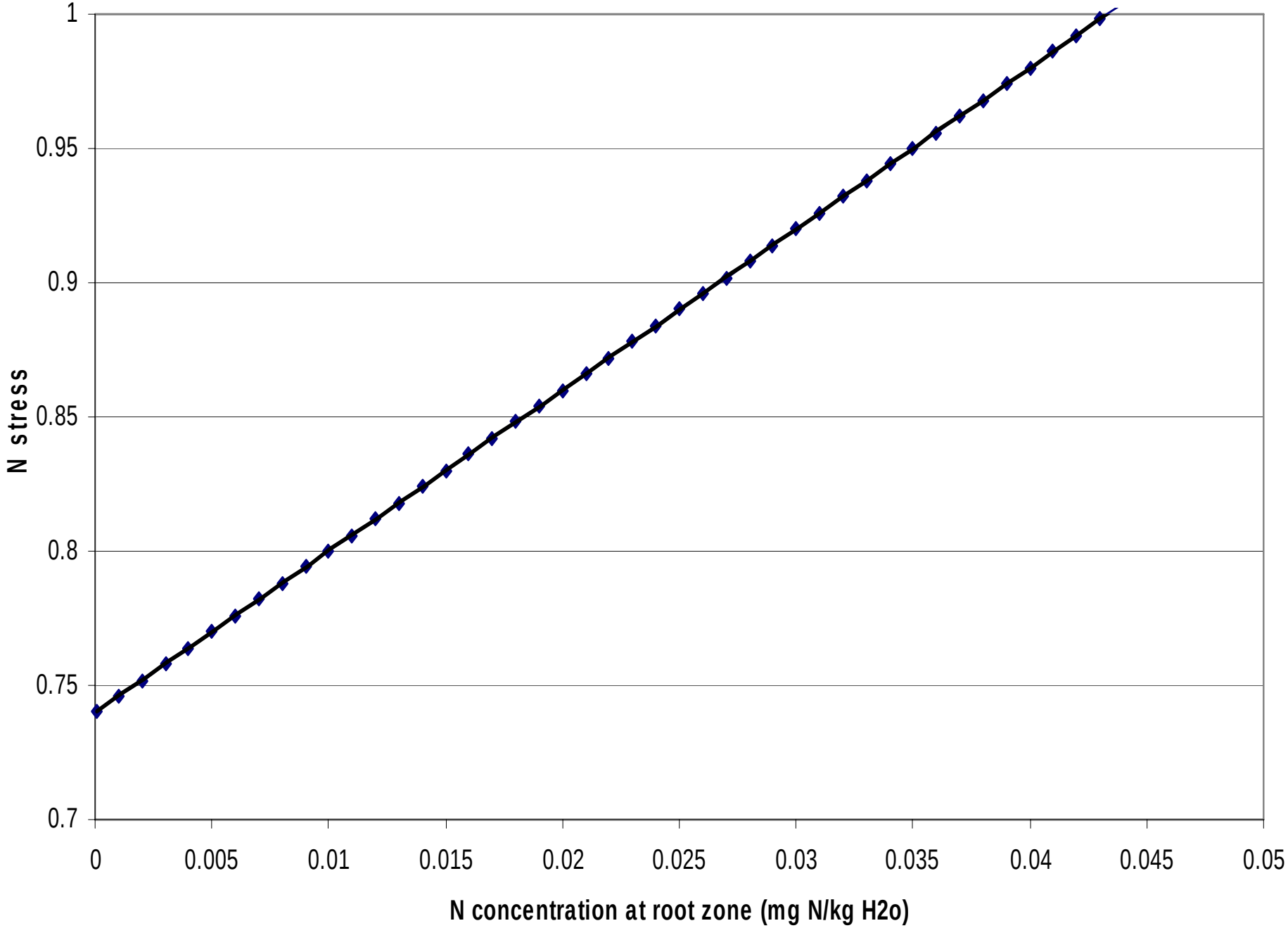
Objective

- **Develop a pecan irrigation-fertilization scheduling model**

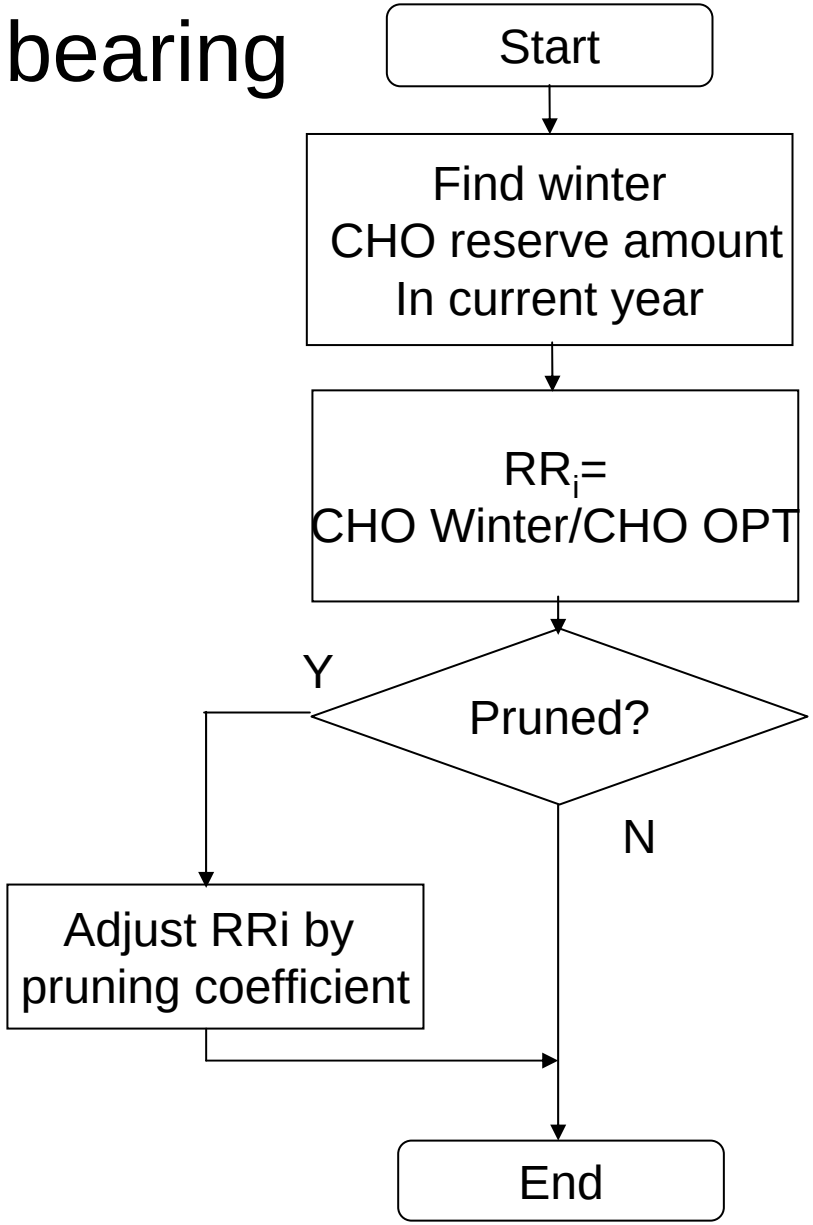
Model general flowchart



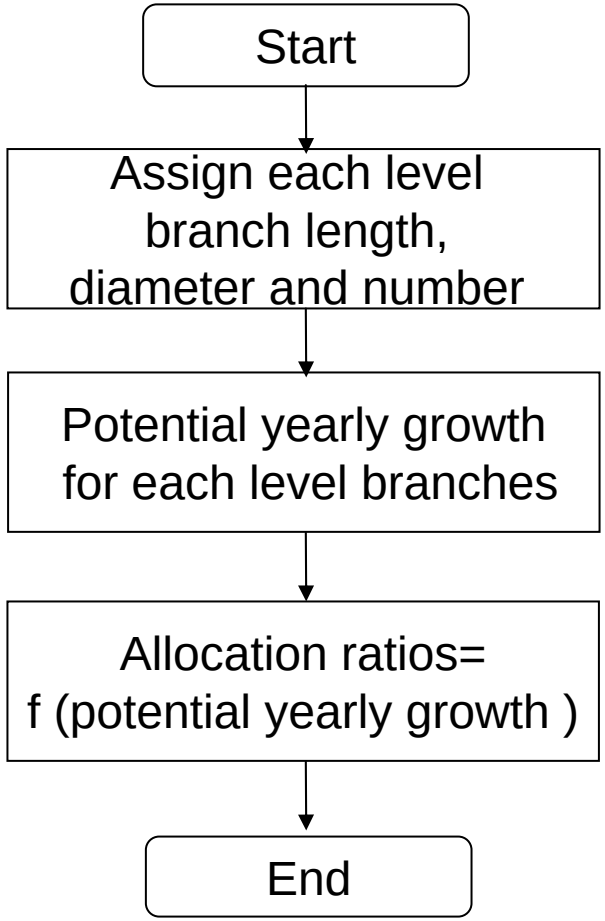

$Kc = 0.286 + 0.003GDDi - 3.02\times10^{-6}\times GDDi^2 + 1.4\times10^{-9}\times GDDi^3 - 2.28\times10^{-13}\times GDDi^4$
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
300
600
900
1200
1500
1800
Growing Degree Days
Crop coefficient OPEC system
Poly. (Crop coefficient OPEC system)

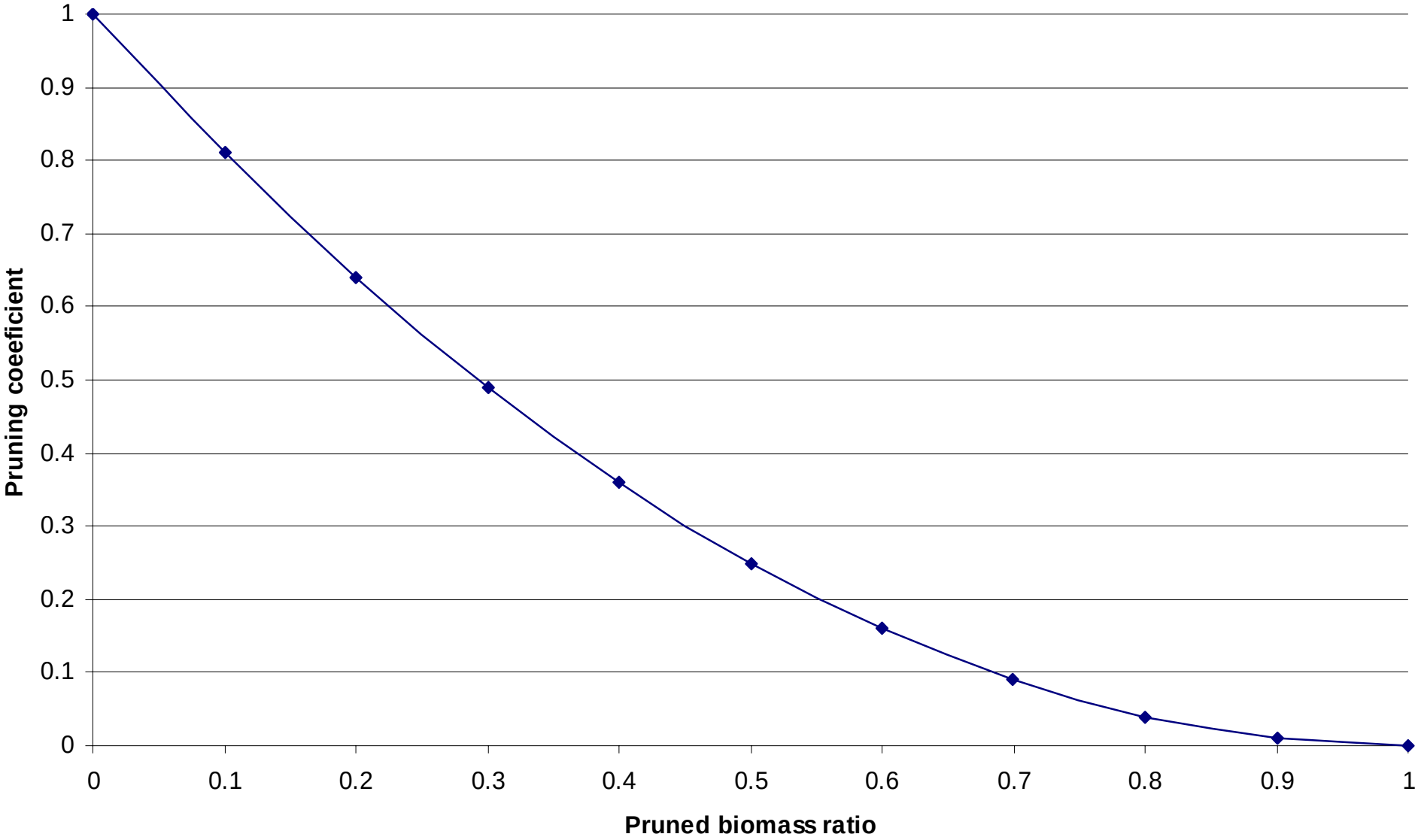

1
0.95
0.9
0.85
0.8
0.75
0.7
N stress
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
0.05
N concentration at root zone (mg N/kg H2o)

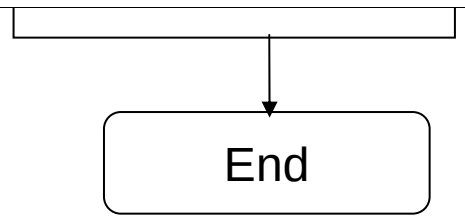
Alternative bearing object



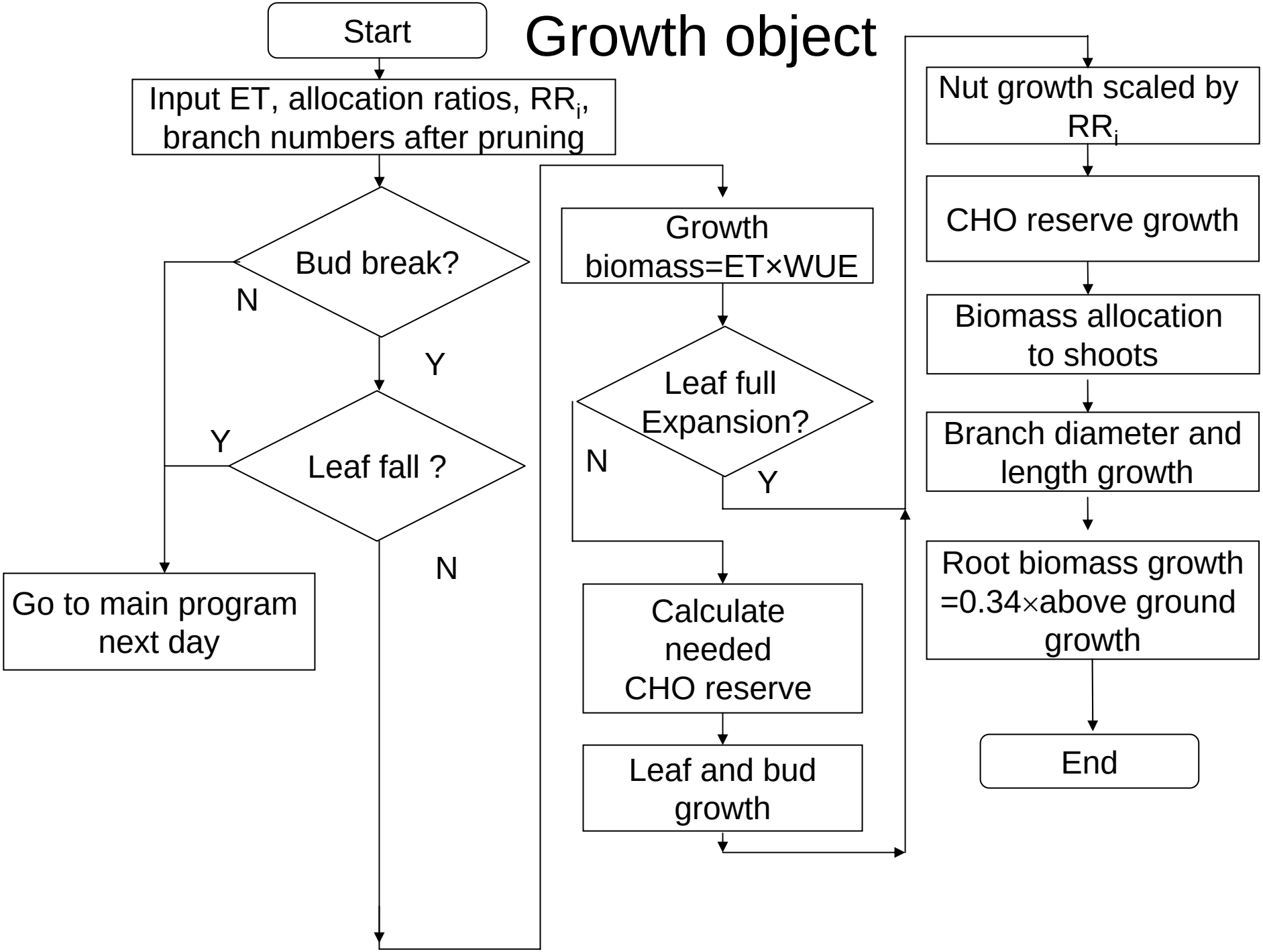
Biomass allocation object




Pruning coeeficient
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Pruned biomass ratio


End

Growth object



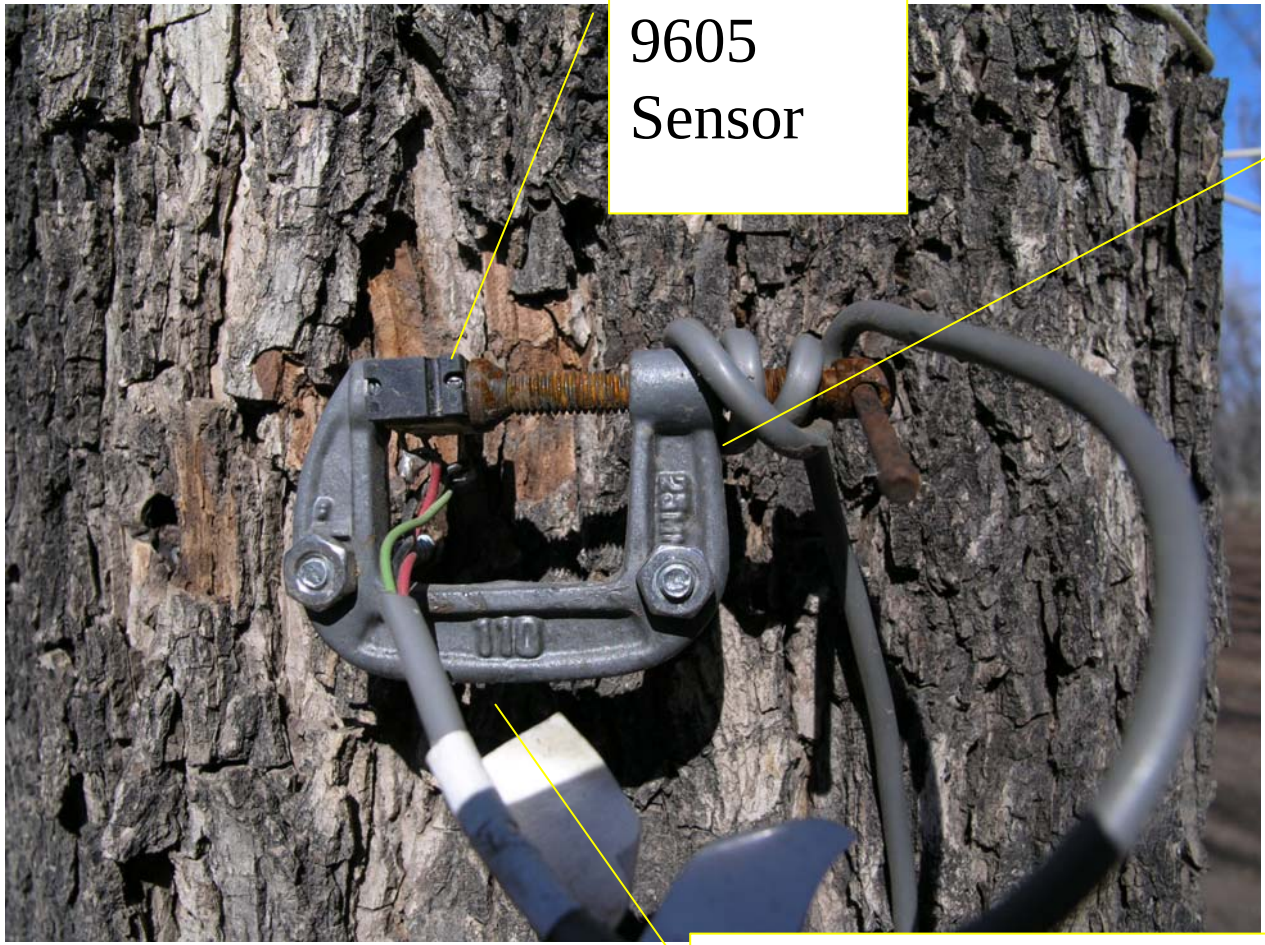
ET and Co2 flux measurement

Leaf and nut growth measurement

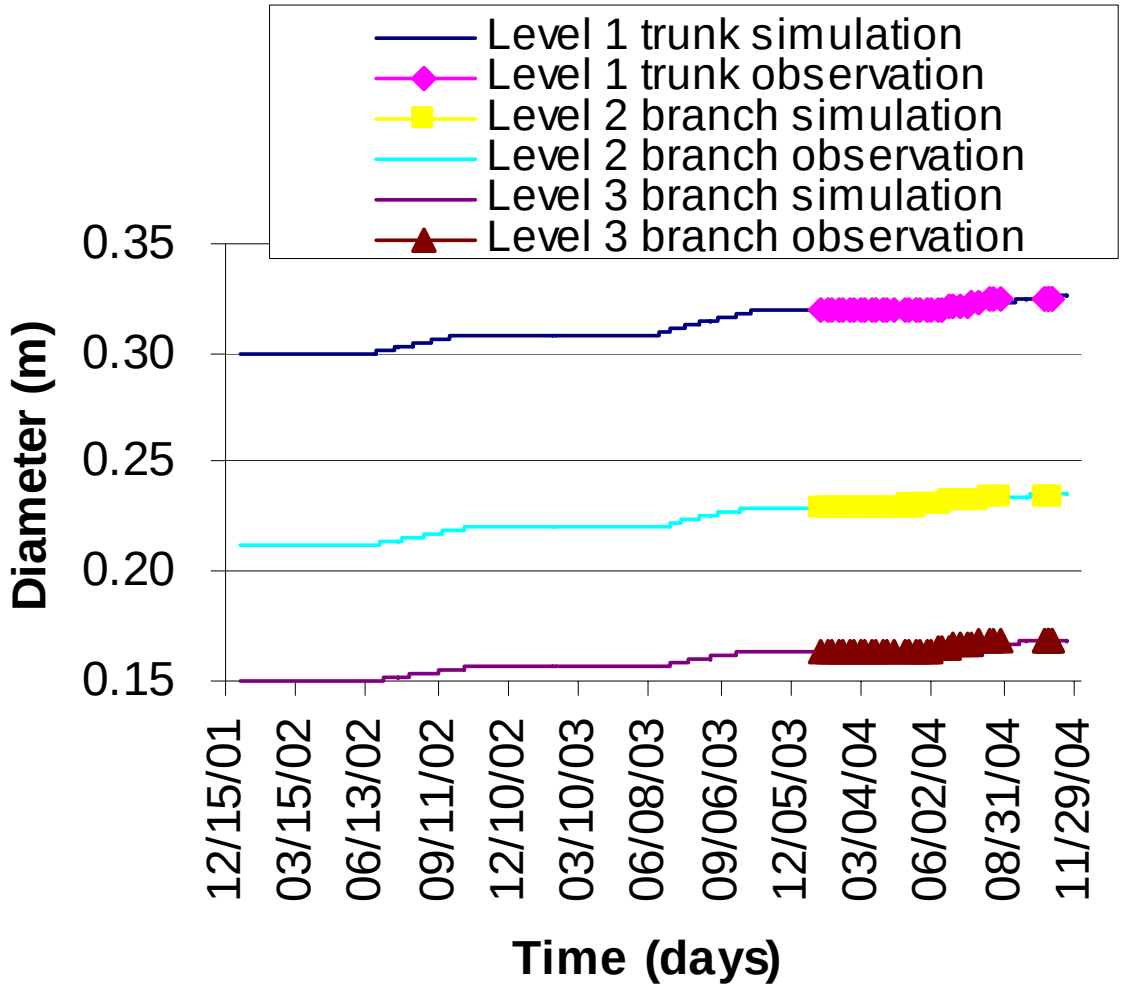
Mettler PE 600
14.85 g

Mettler PE 600
29.3 g

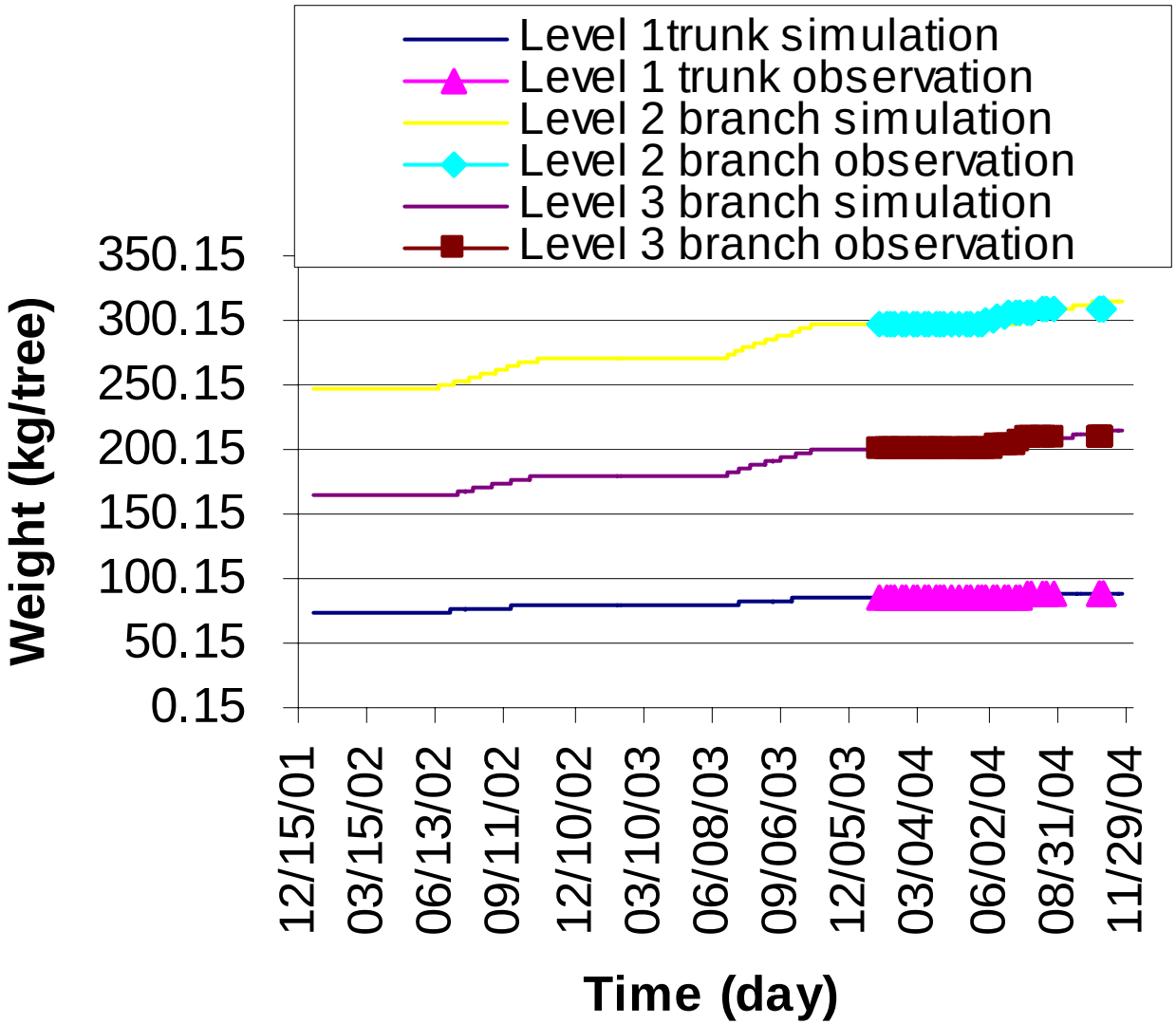
Shoot growth measurement



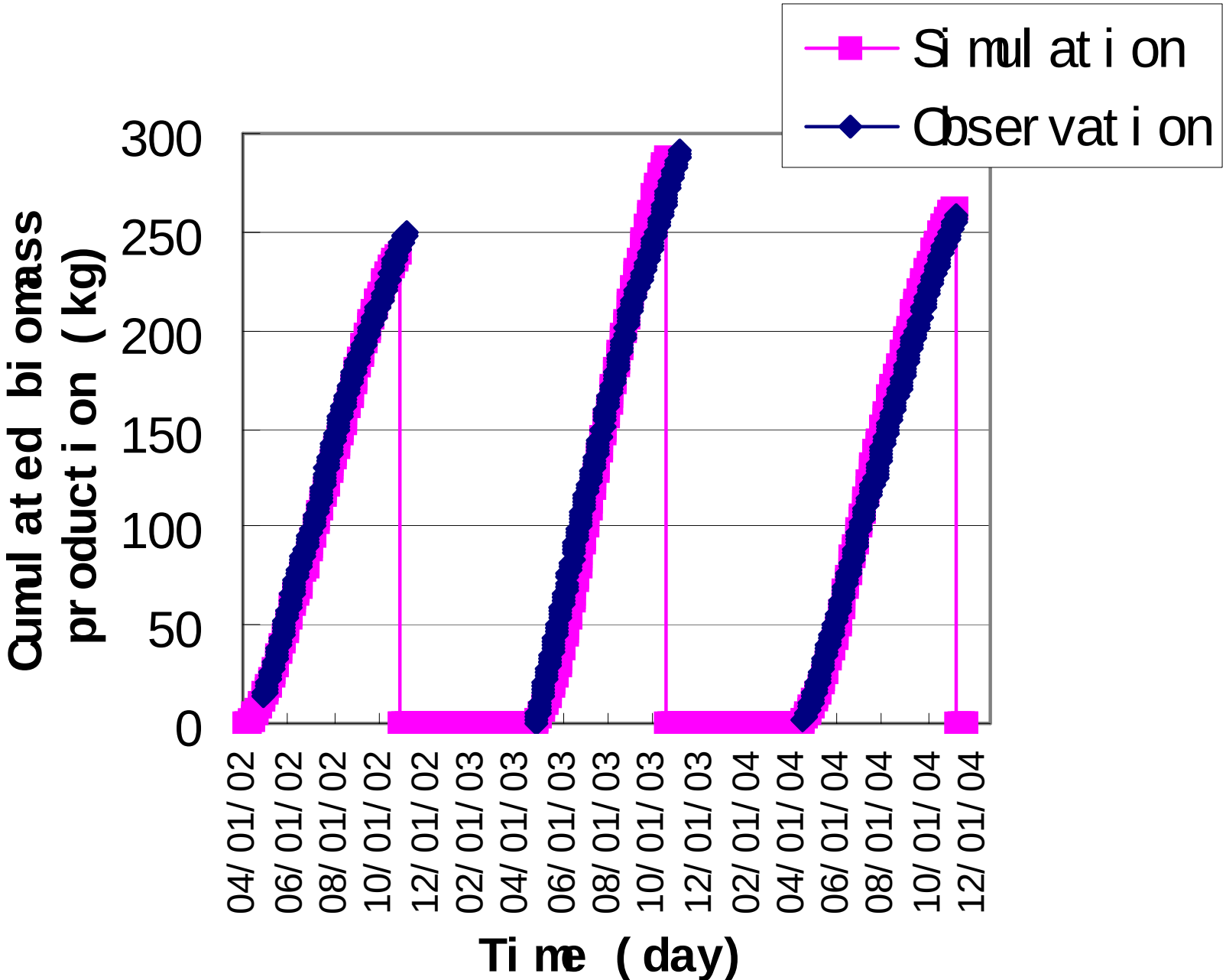
Results
Branch diameter growth



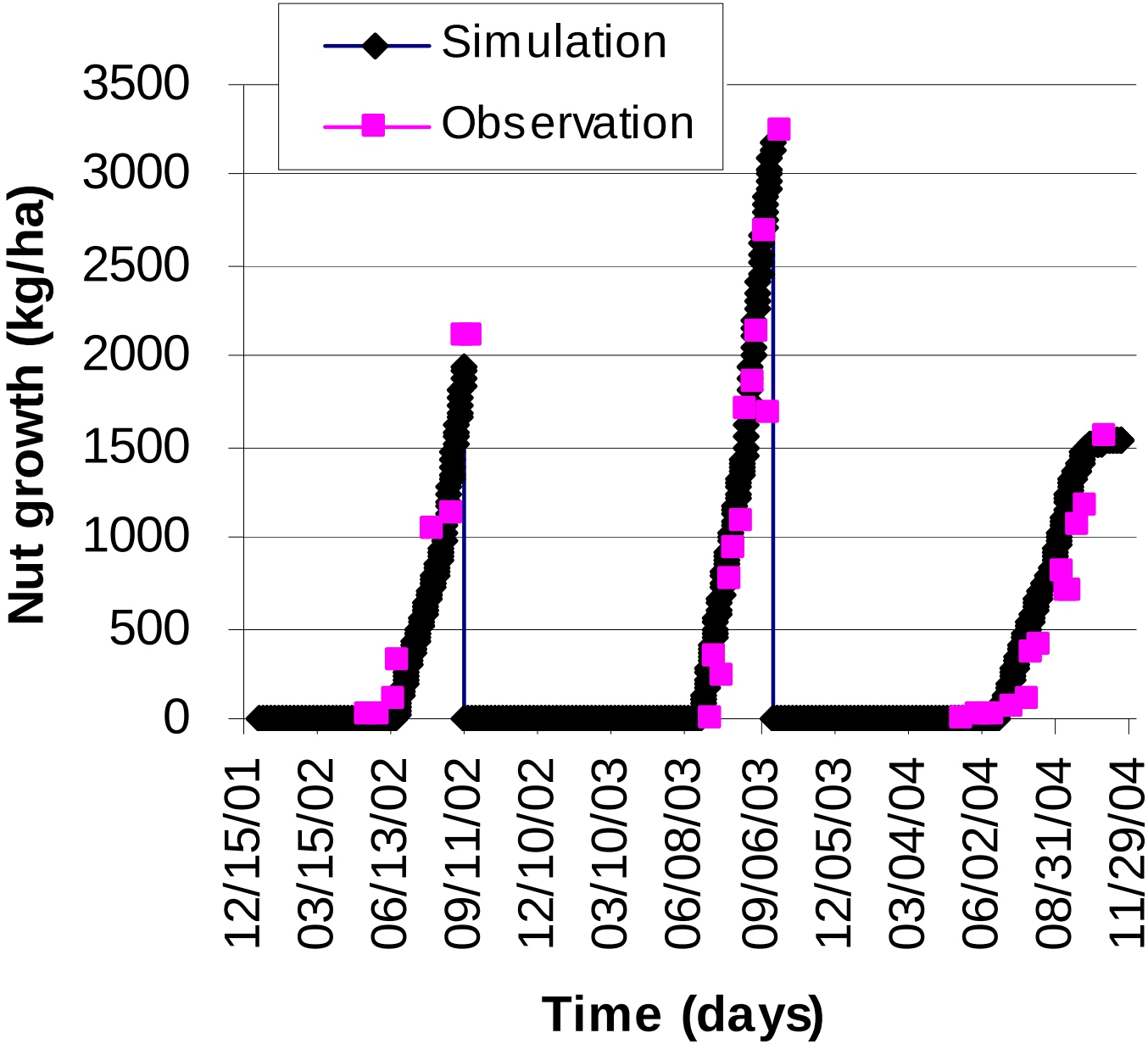
Branch weight growth



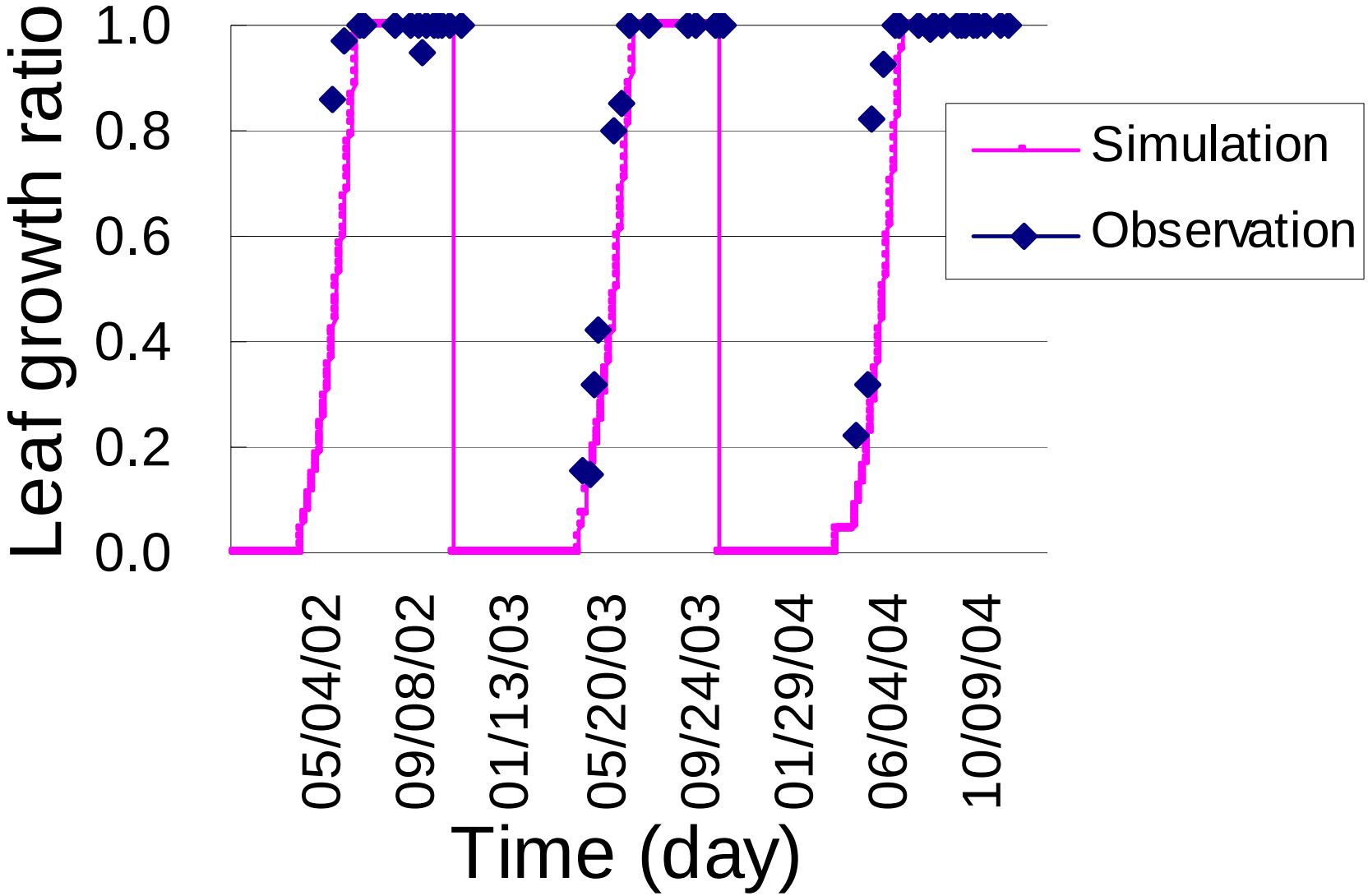
Simulation vs. observation of biomass production



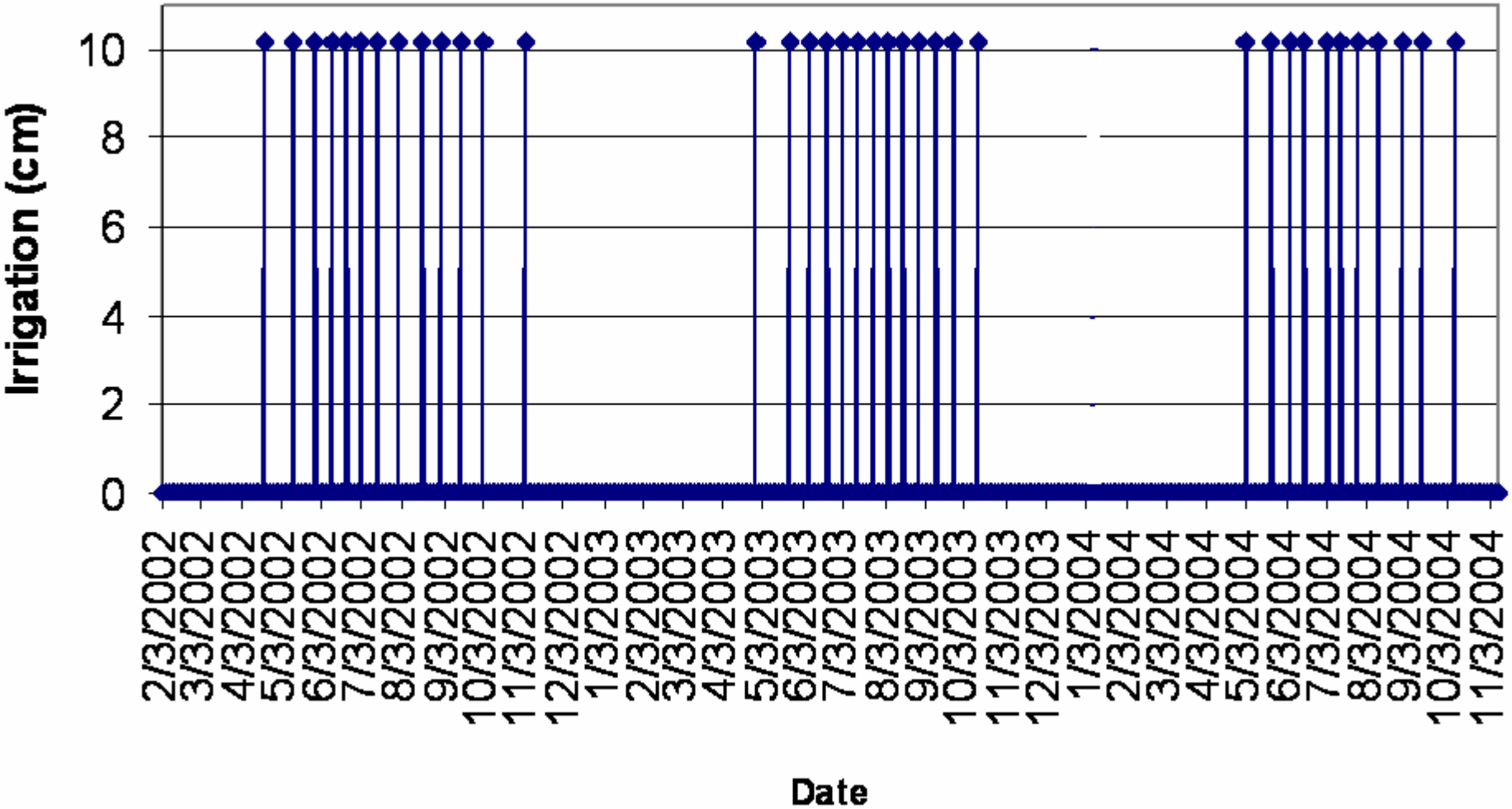
Nut yield


Simulation
Observation
3500
3000
2500
2000
1500
1000
500
0
Nut growth (kg/ha)
12/15/01
03/15/02
06/13/02
09/11/02
12/10/02
03/10/03
06/08/03
09/06/03
12/05/03
03/04/04
06/02/04
08/31/04
11/29/04
Time (days)

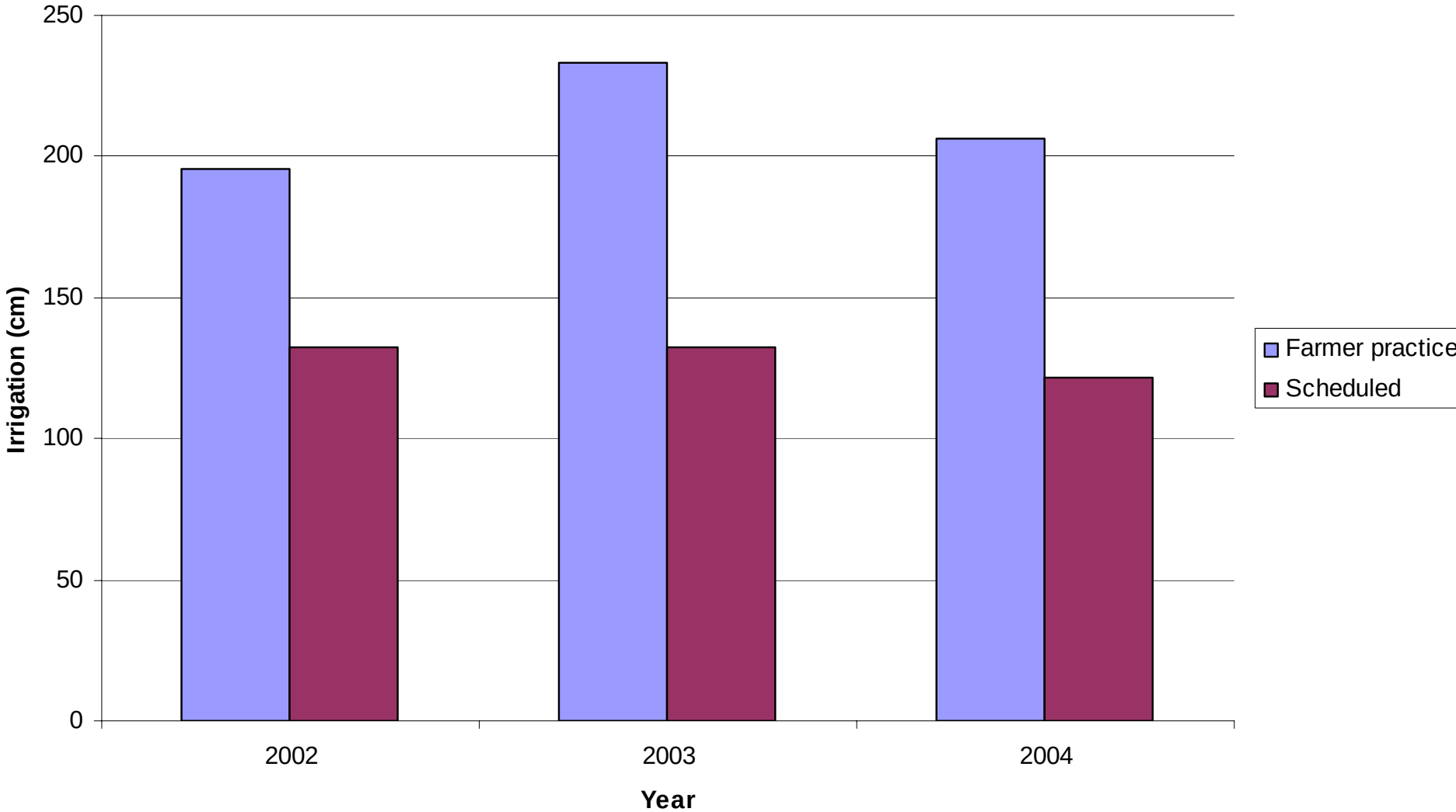
Leaf growth


Leaf growth ratio
1.0
0.8
0.6
0.4
0.2
0.0
05/04/02
09/08/02
01/13/03
05/20/03
09/24/03
01/29/04
06/04/04
10/09/04
Time (day)
Simulation
Observation

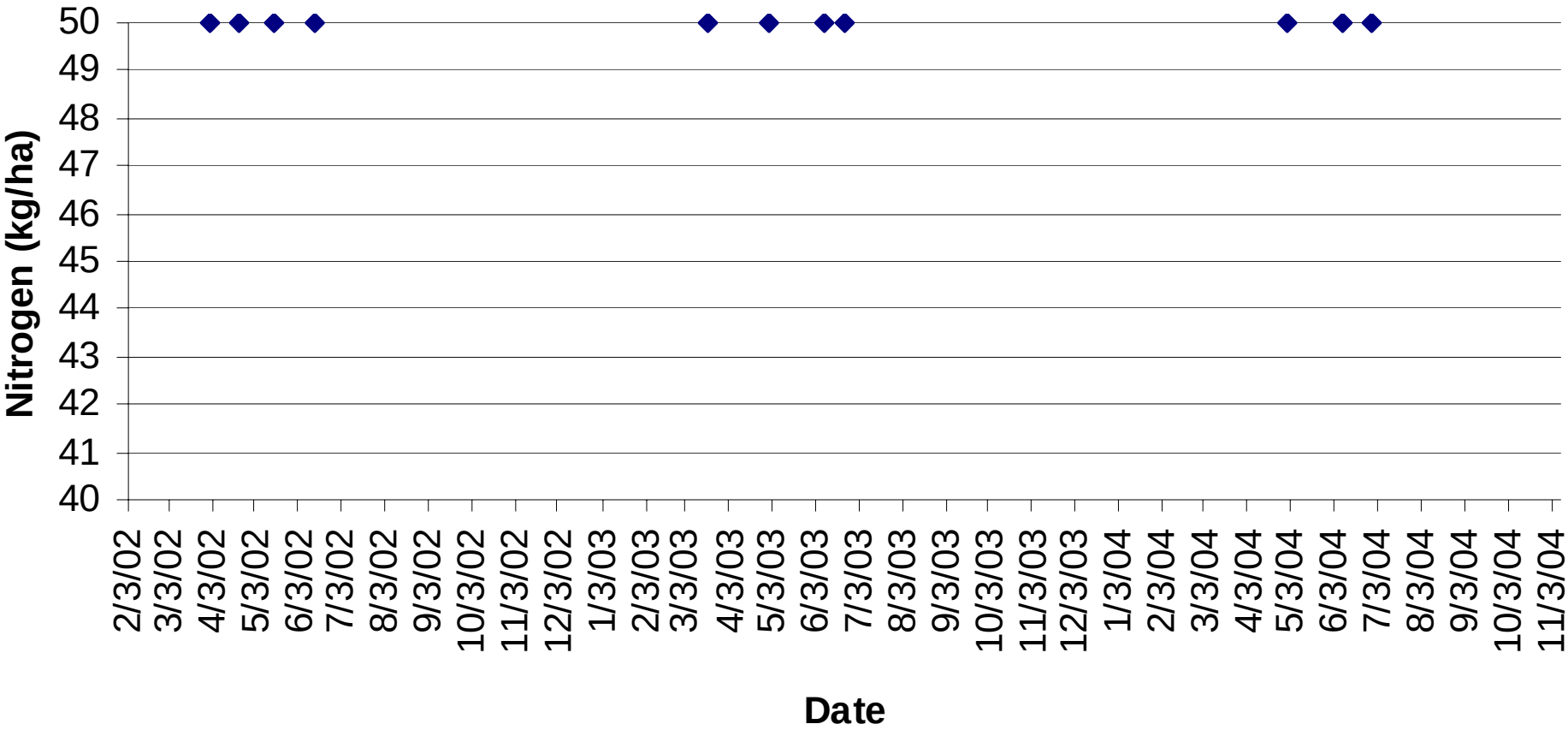
Model scheduling
Scheduled irrigation



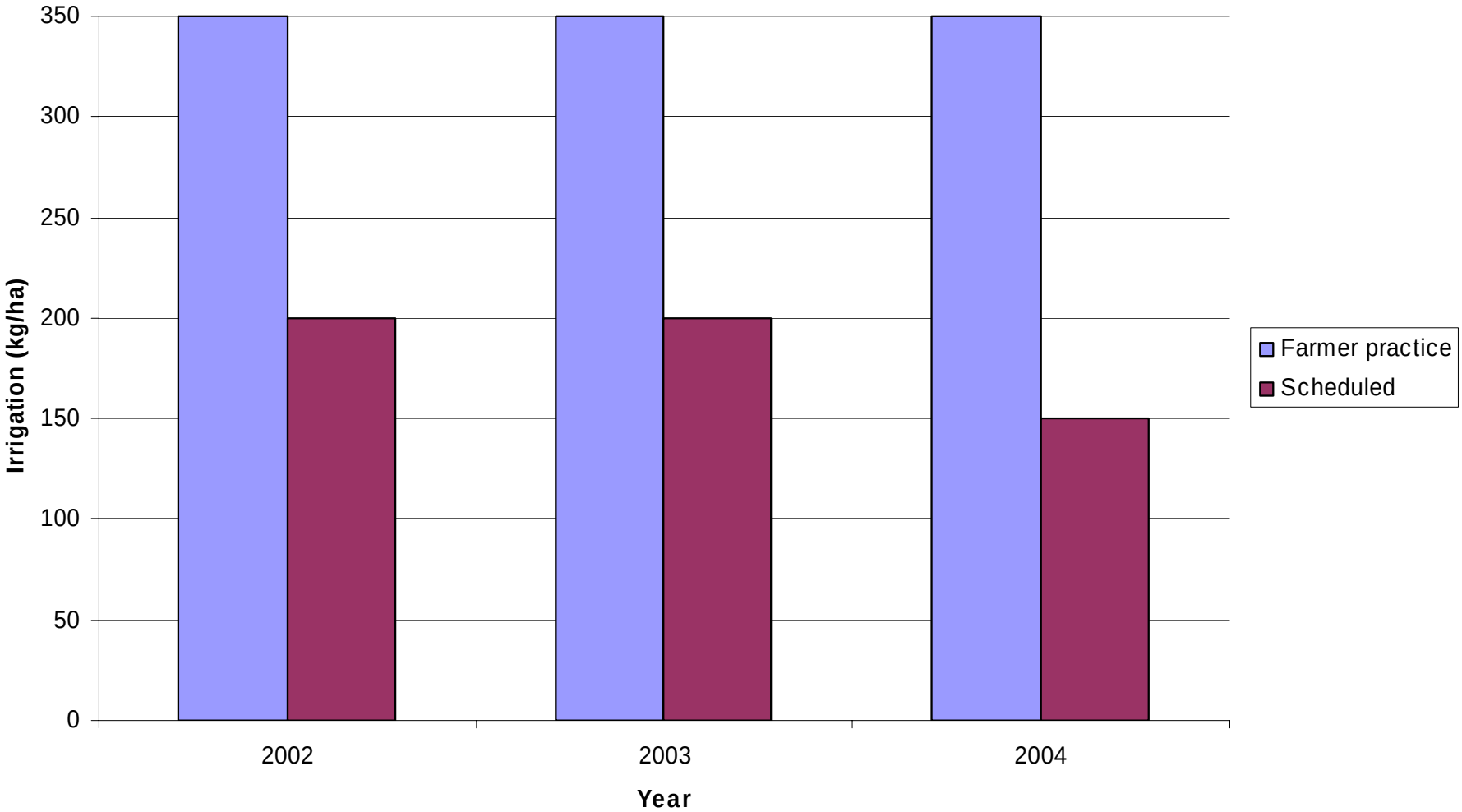
Model scheduled annual irrigation amount compared to farming practice



Scheduled fertilization



Model scheduled annual fertilization amount compared to farming practice



Conclusion

- This model can be used for pecan irrigation-fertilization scheduling.

Future work

- More tests on this model

Thank You!