CROP ROTATION

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Problem, Crop Rotation

What is crop rotation?

- Why do we need crop rotation?
- Which difficulties do we have?

Motivations

1. Why should everyone know a little about crop rotation?
2. How can convex optimization help us with crop rotation planning?

Model

1. One stage linear penalty
2. One stage quadratic penalty

$$\begin{aligned} \max_Q \quad & \sum (Q * L)_i - Multa \\ \text{s.t.} \quad & N_{min} * H \leq N2_f, \\ & (Q^T * P)_1 \leq N2_h * H, \\ & 0 \leq Q, \\ & \sum Q_i \leq H \end{aligned}$$

What about profit percentage penalty?

- Why doesn't it work?

Multistage

- Linear penalty with multistage
- Quadratic penalty with multistage

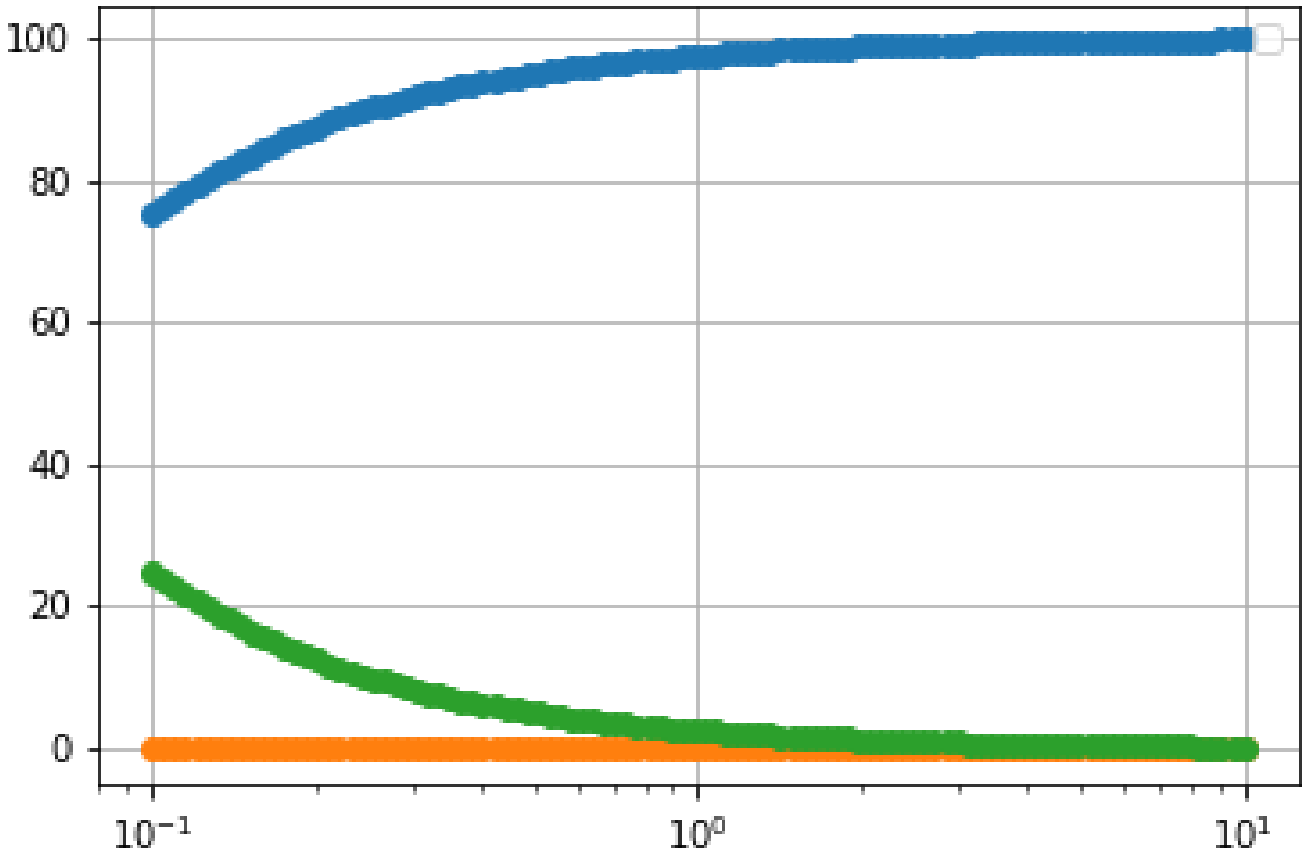
$$
\begin{aligned}
\max_Q \quad & \sum (Q * L)_i - Multa \\
\text{s.t.} \quad & N_{min} * H \leq N2_f, \\
& N_{min} * H \leq N2_f 2, \\
& (Q^T * P)_1 \leq N2_h * H, \\
& (Q^T * P)_2 \leq N2H_2 * H, \\
& 0 \leq Q, \\
& \sum Q_{2,i} \leq H \\
& \sum Q_{1,i} \leq H
\end{aligned}
$$

Problems with N_2 initial amount

- Starting under desirable N_2 amount
- Stating in desirable N_2 amount
- Starting above desirable N_2 amount

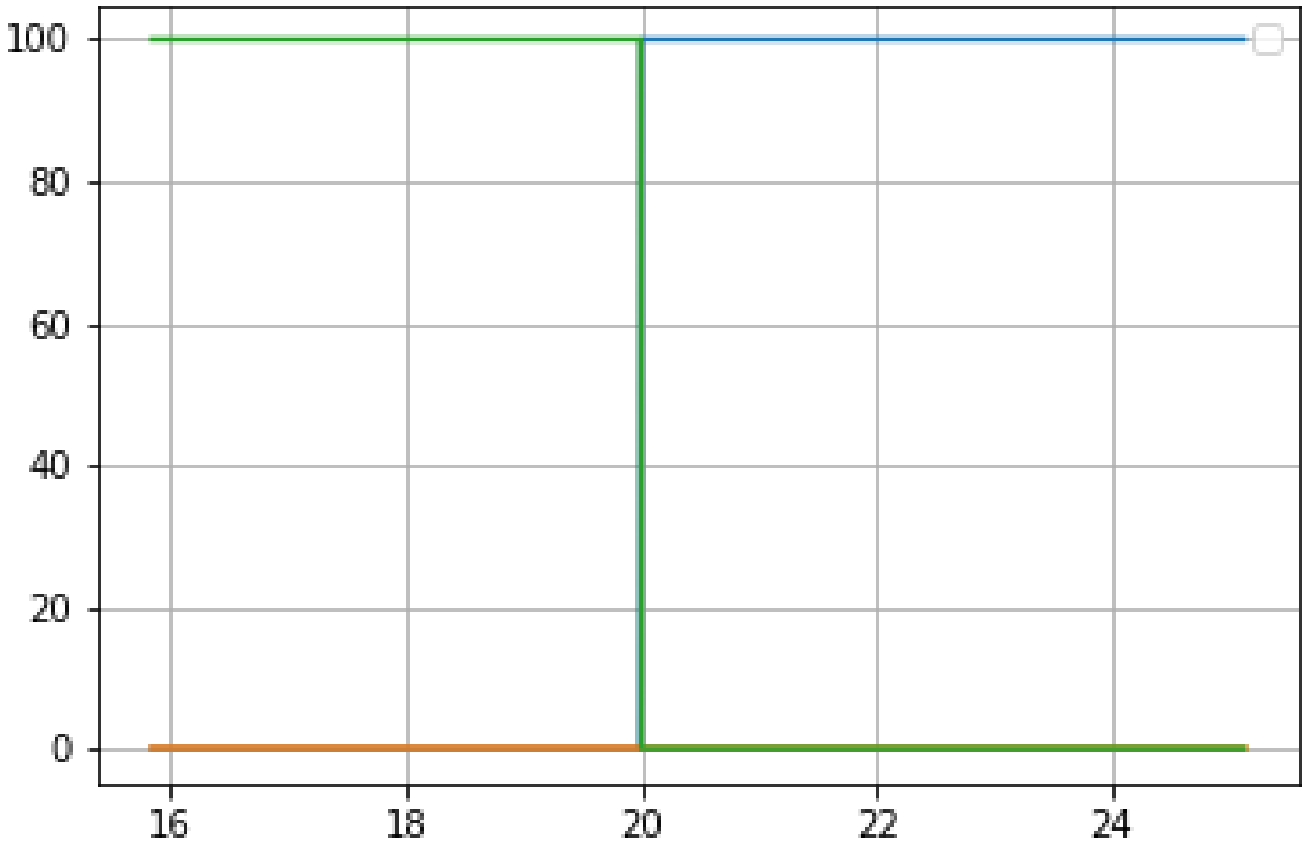
Under desirable N_2 level quadratic penalty

Penfactor/Q1(blue);Q2(orange);Q3(green)



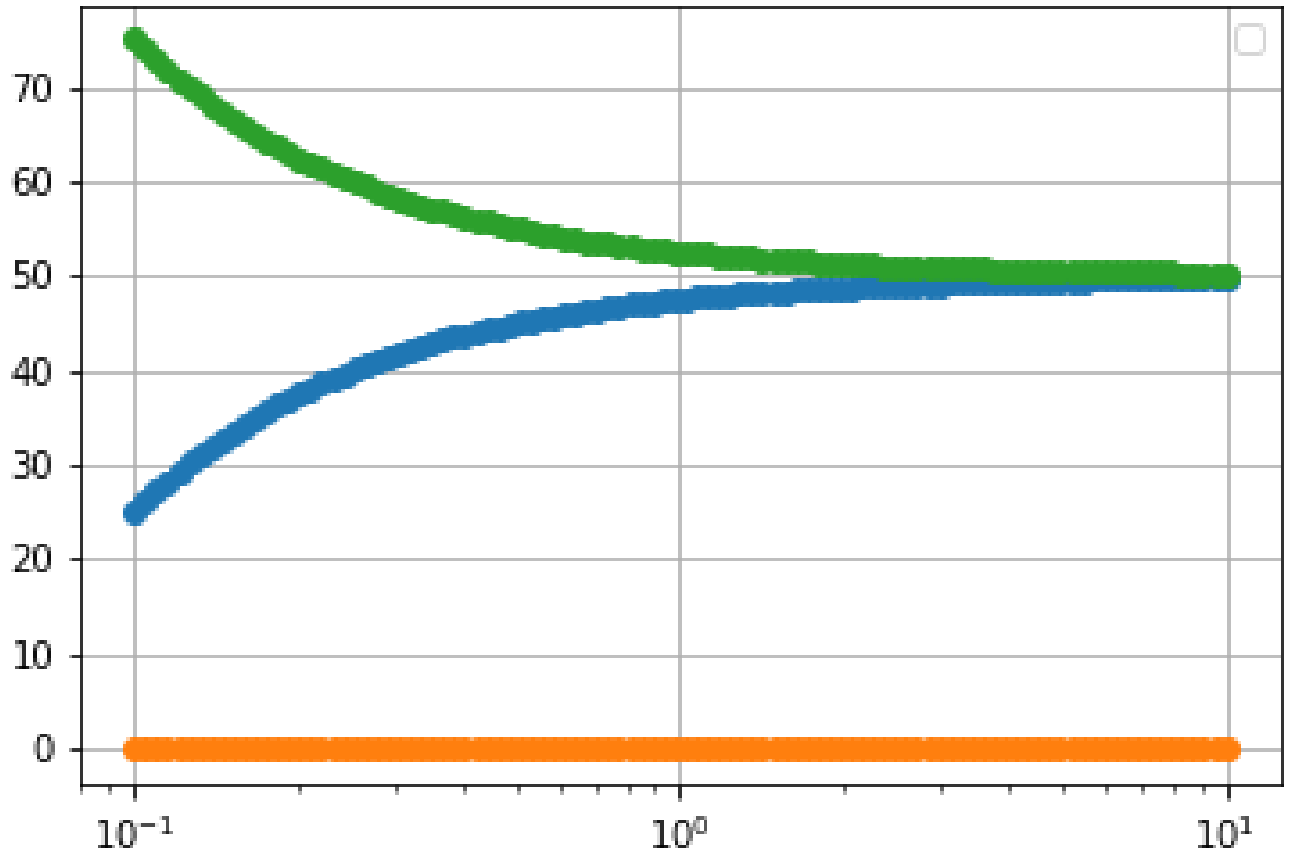
Under desirable N_2 level linear penalty

Penfactor/Q1(blue);Q2(orange);Q3(green)



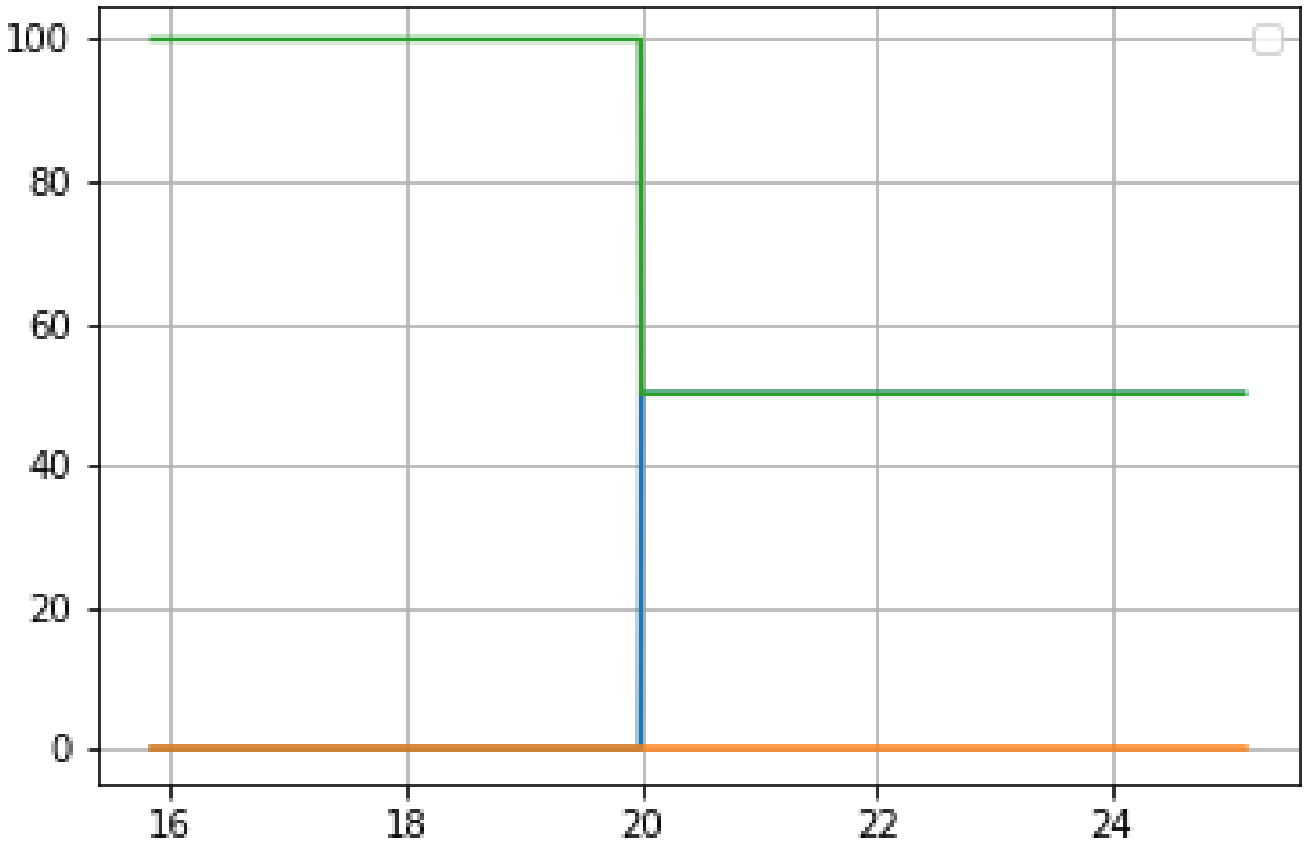
At desirable N_2 level quadratic penalty

Penfactor/Q1(blue);Q2(orange);Q3(green)



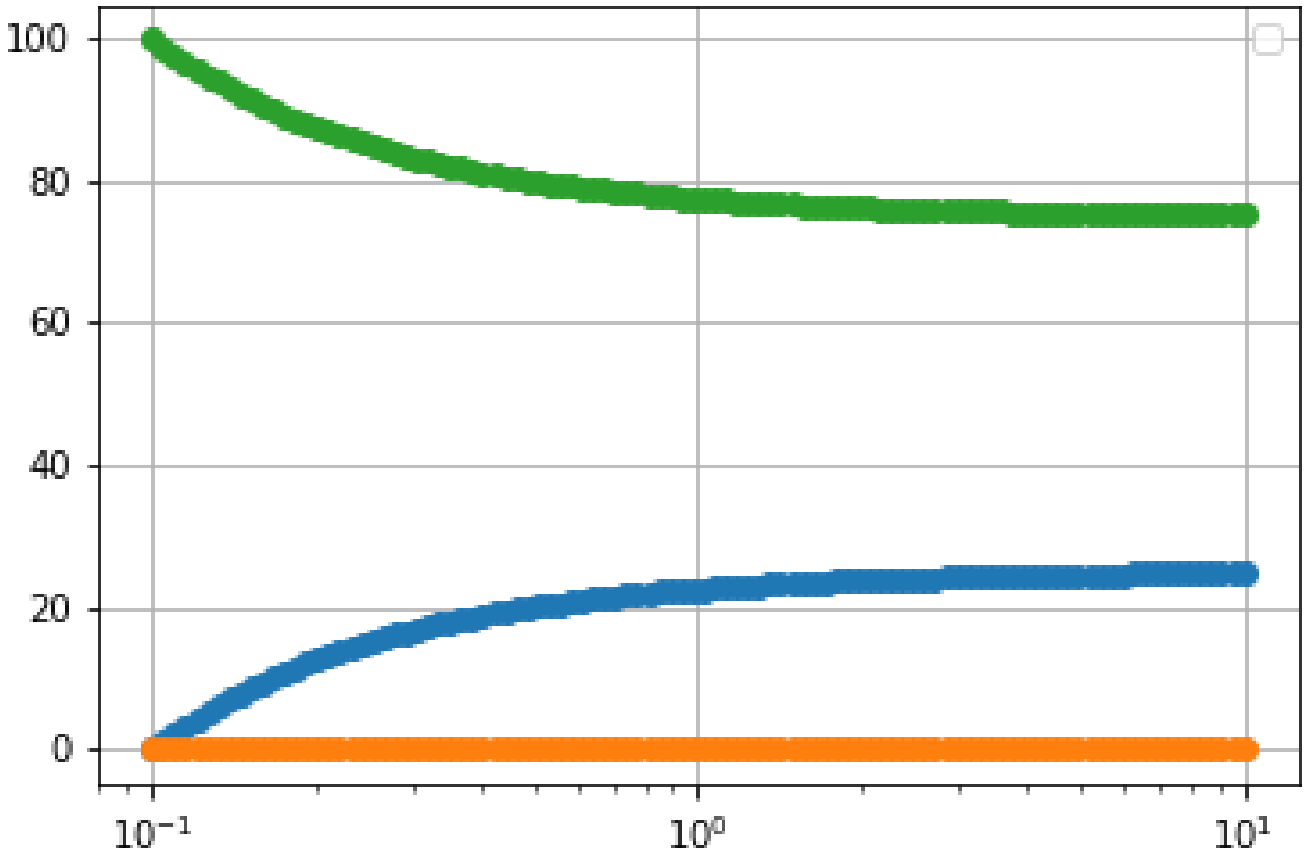
At desirable N_2 level linear penalty

Penfactor/Q1(blue);Q2(orange);Q3(green)



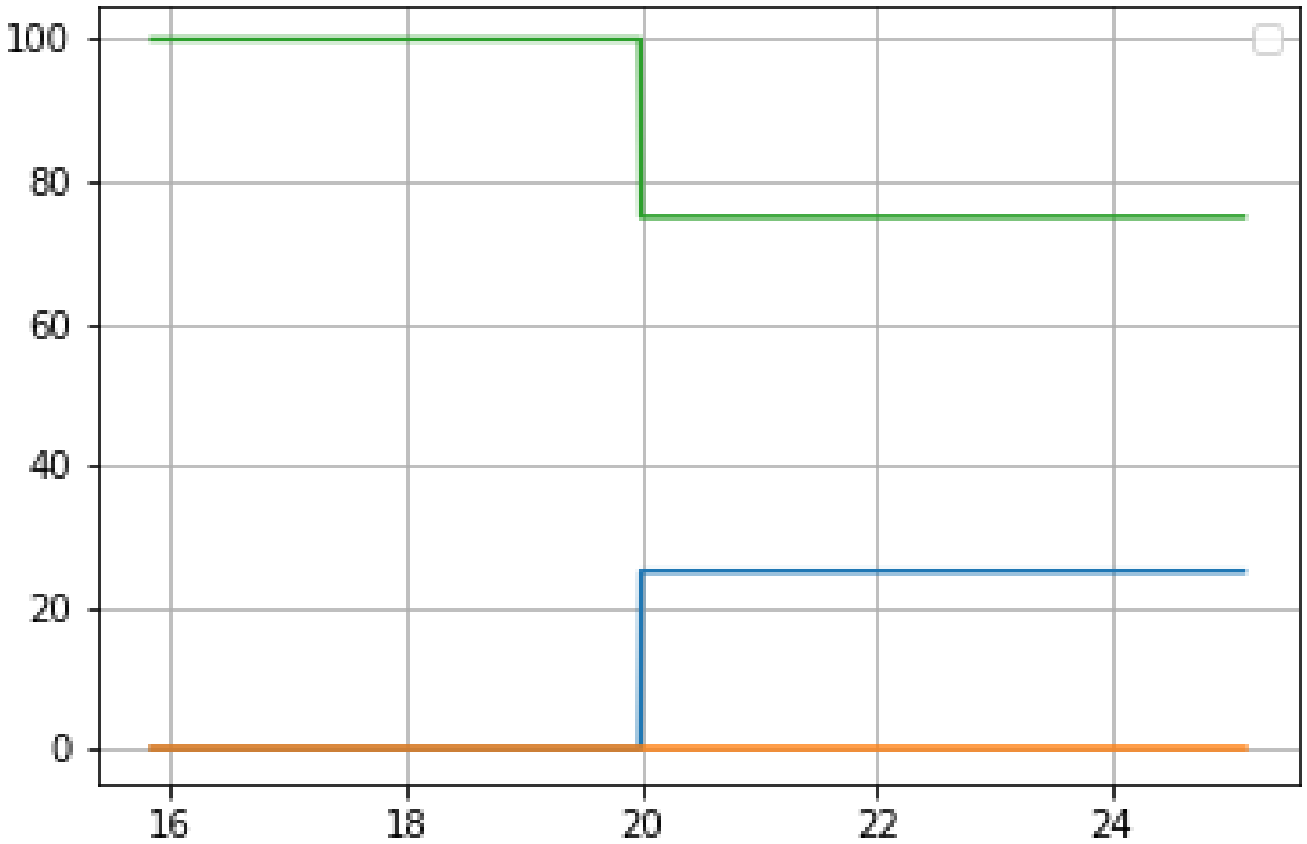
Above desirable N_2 level quadratic penalty

Penfactor/Q1(blue);Q2(orange);Q3(green)



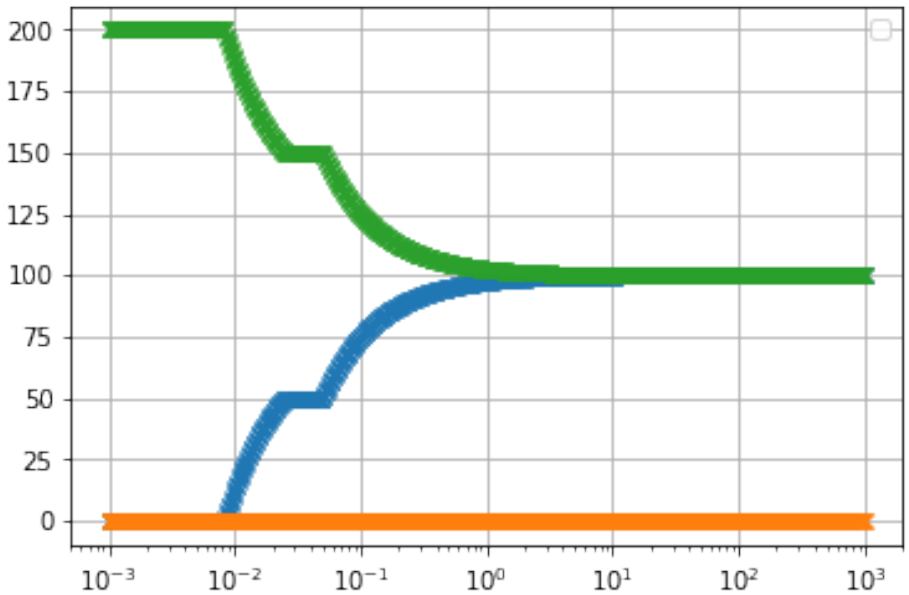
Above desirable N_2 level linear penalty

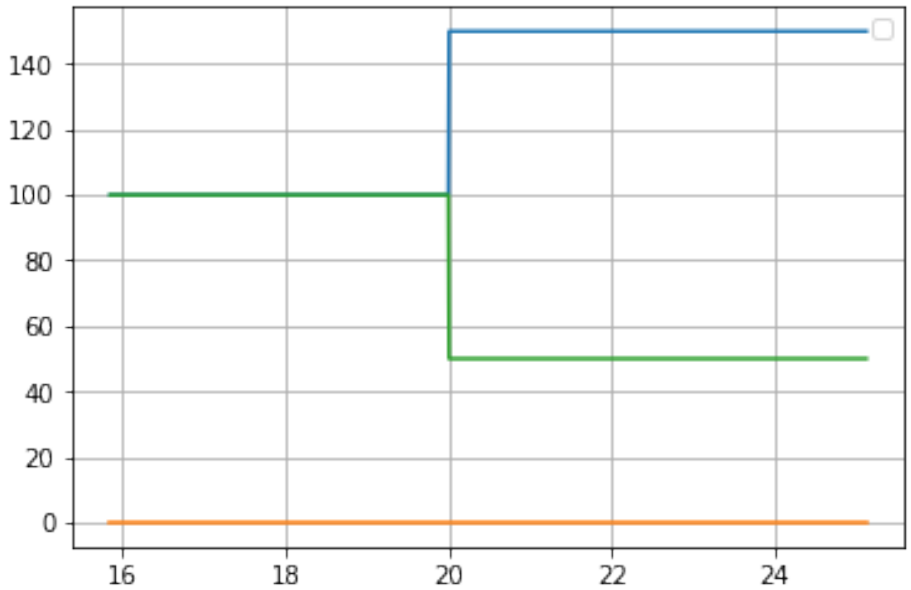
Penfactor/Q1(blue);Q2(orange);Q3(green)



Problem results

Neutral crops have no relevance in the models previously shown.





The desirable N_2 level is reached with the same profit amount.