Achieving uniform spread patterns on non-flat fields by the control of fertilizer spreading

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N°12

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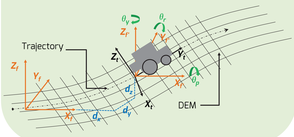
Aim of the project:

- ❑ Managing disturbances related to centrifugal fertilizer spreading (crop yield optimization).
- ❑ Addressing disturbances related to the field elevation and its variation, to develop appropriate corrections.
- ❑ Bridging knowledge gap around over-application and under-application on spread patterns.
- ❑ Assessing the effectiveness of the control solutions, in achieving uniform fertilizer distribution.

Towards uniformity control: three steps process

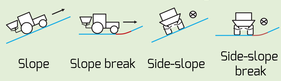
Modeling

- ❑ Updating equations of the ballistic flight of particles derived as a function of: d_x , d_y , d_z, θ_p , θ_r , θ_γ.



Sensitivity analysis

- ❑ Several cases investigated



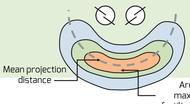
- ❑ Spread pattern uniformity characterized for both positive and negative inclinations.
- ❑ DEMs used being representative for arable fields.

Control design

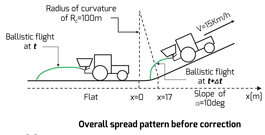
- ❑ Two possible corrections:

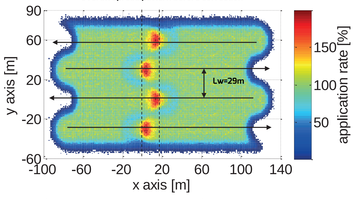
(*I*) discs inclination(*): keeping constant the mean projection distance.

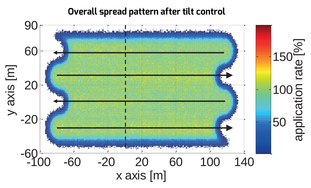
(*II*) flow rate variation(*): keeping the mean application rate at 100±10%

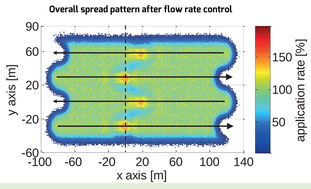


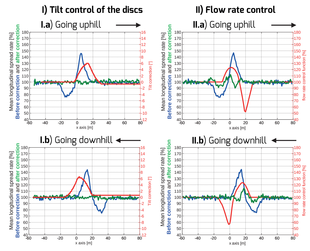
Results for slope break case











- ❑ Discs inclination control requires the knowledge of 3D spread patterns shape along the trajectory.
- ❑ Flow rate control requires the knowledge of fertilizer distribution in the overall spread pattern.
- ❑ Both corrections allow keeping the mean application rate at 100±10% instead of 100±40% before correction.

(*) both control actions were patented.

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