The future demand for an inspection of more advanced features on pesticide application equipment

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Summary

Modern sprayers have a long list of advanced features, which are not proven in the in-use inspection. This optional equipment makes the application safer for the operator and the environment. But is it necessary to test these features if these are on the sprayer or is it enough to make a note in the inspection report.

The presentation gives a short overview about some of the advanced solutions and rise questions what else could be required. The focus is here on horizontal boom sprayers as in this segment the more advanced pesticide application equipment (PAE) is used. But also bush and tree crop sprayer could use certain equipment.

The presentation shows that there will be always a demand for adaptation of the EU directive and also the consultant work of the SPISE group is important for a safer crop care in the future.

Keyword: Smart Farming, precision application, telemetric, autonomous sprayer, remote inspection

Situation:

The inspection of standard horizontal boom sprayers and bush and tree crop sprayers should be seen as common practice. But today the inspection level is more or less analogue technology from the 90th. The data handling has been improved over the years, but the tested equipment is still the basic components of a sprayer, as tank, pump, boom, fluid system and nozzles. The electronic features and sensor technology is not part of the inspection today.

There a two major challenges:

- How to test an equipment in an workshop
- Which standard should be the base for the inspection

Example of an advanced boom sprayer: HARDI COMMNDER i TWIN FORCE - with ISOBUS Terminal, AutoSectionControl, AutoWash, AutoHeight boom management system and remote data management

Technical features

On a modern sprayer are different technical features used to improve the performance, this could be only to support the operator, so he has less stress or to or he can drive faster for to cover more area in the same time. But mainly these systems are used for a more precise and safer application. Finally all equipment will support a possible reduction in pesticide use and gives in this way a better sustainability.

This paper is not giving technical details, as this would require more space, but in the presentation more details will be discussed.

Generally it can be mentioned that there are always one or more sensors, which are connected to control unit, which uses smart algorithms to optimise the functionality of the sprayer. This means in the case of inspections, that either the sensor function must be proven or the function of the whole equipment!

- Automatic GPS based switching of sections get more and more common. These systems lead towards a reduction of plant protection products, as the amount of overlapped areas is minimized; the amount of reduction is belonging to the field size, field shape and the width of the boom sections. The reduction of plant protection products is between 3 to 6 %. The difficulty is the calibration and adjustment of the systems. Simply said it must be proven if the technical dimensions are correct and is the system working in the correct way. On ISOBUS sprayers is the automatic section control a task controller function and the performance level is belonging to the terminal and not the sprayer ECU, which could be difficult to proof. But also simple questions as how to proof a GPS receiver, if an indoor inspection are done.
- **Boom height management systems** support the operator big time; and on new sprayers 75 % of the bigger boom versions have an automatic boom management system on. These allow higher driving speeds and also reduce drift as the booms can be driven lower to the target, which lowers the drift potential. But there are different technical solutions available, for example some systems work only over the slant cylinder, others use only the tilt function of the boom wings, and there are also system using both functions. There is also a wide variation in the performing level.

  From the sprayer inspection view point the performance level can't be tested, only if a system, when it is present, it should work.

  There is also a risk if the system is in automatic mode and has a wrong setting or sensor failure the boom could be also in a too high position, than the drift risk is higher and performance could be poor.
- **Smart Farming** is a broad area, but when focusing on application it is more or less the work with different volume rates per area. The area could be small, even down to m^2; and the dose rate / flow rate could vary a lot. Which in a perfect world would require different flow rates per boom section or per nozzle? But how to proof solutions like this? There are different methods for nozzle inspection; here it would be ideal to use a combination of these. For the inspection at least a recommendation is required, how to verify sprayers like this in the case of inspection or a risk assessment must be done if systems are environmental safe.

  In Smart Farming a lot of **data management** is involved, as the application decision can either be taken before the spray job, then it is an application map which the spray control will followed. Or the application decision is taken by a sensor on the machine or on a drone and is than in real time managed on the sprayer. Nevertheless reaction time and precision are major players in that process, but how to measure this in a stationary inspection.

  Also automatic functions and processes of the fluid system as AutoWash and AutoFill can be documented.

In this application segment are also Pulse Width Modulation, Multi-nozzle variable application, curve control and also direct injection techniques in.

- Future sprayers will offer **telemetric** connectivity and could offer a **remote inspection** of correct functionality. But what inspection level is required, only the basic functionality or do we need specific requirements for the telemetric components.
  It could be possible to do a real time observation on all electronic components, including boom height, spray pressure etc. Here it could be also a conflict with data security.
- **Autonomous sprayers** or a group of smaller sprayers in a swarm could or will be getting into the field. In which category are these PAE? Clear guidelines are demanded! Has an autonomous sprayer be tested more often, or does this need data locking? This is a wide area which will develop in the next years and it would be good to know what safety level is demanded. Who is the operator of an autonomous sprayer?

Remote inspection

Here is a big chance to improve the performance level of PAE. If all important electronic functions can be observed, the operator has a daily inspection possibility. This system must be able to group the data from different sensors to a readable value, as example data from flowmeter, pressure sensor, driving speed gives the volume rate l/ha. Here a definition is needed what data must be available for the inspection. It is a type of a traceability process.
A remote inspection could lead to a far higher level in food production, for example in the vegetable production, fresh food needs to have the highest security level, as it goes direct from the field to the consumer.

Conclusion

Advanced technical solutions offer a lot of opportunities, up to real time observation of the pesticide application equipment. But there is always a risk of wrong functionality, which could lead to environmental problems.

There are a lot of open questions, where a common understanding is needed, to do an environmental safe application.

The SPISE community is doing a lot of specific solutions for all type of application equipment as this is part of the requirement from the EU commission. But there will always be a demand for adaptation of the EU directive, but who can officially decide what the correct application is? Here the consultant work of SPISE is important for a safer crop care in the future.