

Sprayers adjustment at the workshop thanks to the use of a dedicate software

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Summary

In Piemonte Region, the instrumental adjustment of sprayers is compulsory when the farm comply with sustainable production standards and for this reason draws European subsidies. To ease the task of technicians involved in this assignment, the regional administration - in collaboration with the Information System Consortium (CSI) and the DiSAFA (Torino University) - developed a dedicated on line software as an integration of the current one that is suitable for functional inspection only.

The software is accessible to qualified technicians only and is split into two parts according to the type of sprayer (either boom sprayer or sprayer for bush/tree crops). Data concerning type of crops, treatment, crop canopy (for orchards only), nozzles, operative parameters (pressure, forward speed, applied volume etc.) are initially collected on a paper form and then typed into the software. The last section of the software is dedicated to the sprayer instrumental adjustment and it provides the results achieved with the use of the test benches (optimal boom working height for field crop sprayers and vertical distribution pattern for air assisted sprayers). The result of the adjustment can be print as a report and delivered to the farmer.

Introduction

Article 8 of the EU Directive 128/2009/EC foresees that professional users have to be properly trained about the procedures to be followed for an appropriate sprayer calibration/adjustment. Sprayer calibration made at farm level is however limited due to the lack of specific instruments/devices necessary for this operation.

An off-field sprayer adjustment can therefore be made from time to time at the authorized workshops as a complement of the mandatory sprayer functional inspection. This activity should be carried out for the main crop type present in the farm by using specific test benches to verify if the emitted spray plume matches the target crop shape and dimension (bush and tree crops sprayers) or if a sufficient evenness of the transversal spray distribution (field crops sprayers) is achieved.

The Piemonte Regional Administration, considering that a correct sprayer adjustment is a key factor to achieve an effective reduction of the environmental impact related to the plant protection products application, has promoted this operation through the assignment of economic incentives for farmers based on EU funds. Off field sprayer adjustment should be made at least once every 5 years.

To facilitate the authorized workshops in managing such activity, following also the indication reported in the Spise Advices for sprayers adjustment (Balsari *et al.*, 2015 and 2016), a dedicated on line software was developed by the Information System Consortium of the Piemonte Region (CSI) with the support of DiSAFA – University of Torino.

This software is a web application inside the Internet portal of CSI and developed with a Java technology. It is located in the application server JBoss. Data are stored on DB Oracle. It is available with main internet browsers like Mozilla, Chrome, Safari.

Materials and Methods

The regional official procedure requires that data concerning sprayers adjustment are at first recorded at the workshop by using a specific paper form. Data are afterwards uploaded to the on line software by authorized technicians who successfully passed a specific examination (complementary to the authorization for sprayers' functional inspection).

The software is suitable only for brand new sprayers or for sprayers that already successfully passed the functional inspection (mandatory for five or more years old sprayers). Furthermore, the software can be used only for those sprayers which specifications (e.g. brand, model, type, vehicle identification number) have already been uploaded to the regional informatic tool used for issuing their functional inspection.

Software utilization

As a first step, the technician has to identify on a pre-loaded list the farm owning the sprayer that has to be adjust. From that point on the software' screenshots are different according to the type of sprayer (either for field crops or for bush/tree crops). The software is not designed yet for lances, cannons knapsack mistblowers, foggers, etc...

Once all space have been filled up with the requested data, it is possible to print the adjustment report and delivered it to the farmer.

Below the information concerning the use of software according to the type of crops are schematically summarized.

Field crop sprayers

Information concerning working width, utilized configuration are already available as they are pre-loaded into the software during functional inspection.

As a second step, the main crops treated by means of the sprayer have to be selected from a list of options grouped into homogeneous categories (table 1).

Afterwards, the type of treatment (herbicide pre or post emergence, fungicide or insecticide) has to be selected (table 2).

Table 1. Possible crops to be choice as those in which the sprayer is used

maize/sorghum/sunflower/soya
wheat/barley/oats
rice
horticultural crops and strawberries
horticultural crops and strawberries in greenhouse
other

Table 2. Type of Target and treatments

paddy field ground (pre-emergency) weed with vegetation up to 10 cm high (post-emergency) weed vegetation over 10 cm high (post emergency) other treatments (fungicides, insecticides)
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For all selected cases (besides case "a") it is also necessary to indicate whether the operation is performed: broadcast or on band.

For each type of crops/target-choice shall be performed a specific sprayers adjustment and the additional following data have to be provided:

Nozzle type (flat fan, twin flat fan, hollow cone, mirror, pneumatic, centrifugal), model and manufacturer;

Nozzle distance (m);

Working pressure (bar);

Flow rate (l/min)

Forward speed (km/h);

Application rate (l/ha).

Some of these data can be recovered from the sprayer functional inspection report. Nevertheless, the inspector can discretionally suggest different settings to achieve better performances.

If the sprayer is equipped with an air sleeve, its main purpose (drift reduction or better canopy penetration) has to be indicated in the report as well as its suggested inclination (if adjustable).

The indication about the air speed adjustment within the air sleeve is not compulsory. Nevertheless, when the necessary instruments are available at the workshop it is possible to include this data in the dedicated software space

A blank space is also available in the software for further indication the technician consider to be useful for the farmer in order to allow him to appropriate use the sprayer.

As last step, the optimal boom working height with respect to the considered operative conditions (those choice in table 2) is indicated. The latter is the result of a measurement made thanks to an horizontal patternator.

For each selected treatment and crop (from points "a" through "e" of table 2) it is necessary to perform an instrumental measurement (even though the others operative conditions – those of table 1- don't change) and fill the relative software space.

Bush and tree crop sprayers

Information concerning the number of treated rows per each sprayer passage and related to the fan main characteristics (when it is present) are already available on the software and visible on the screen as they were pre-loaded into the software during sprayer functional inspection.

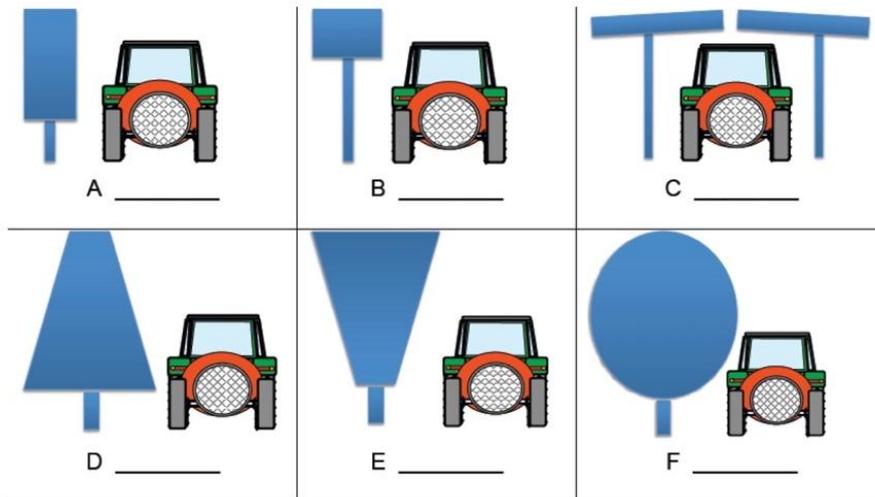
Similarly, to field crops, the main crops treated by means of the sprayer have to be selected as well as the treatment type (Table 3):

Table 3. Possible crops to be choice as those in which the sprayer is used

Vine
fruits
hazelnut, walnut
kiwifruit
blueberry, raspberry, currant, etc
olive
other

For each crop it is also necessary to indicate (choosing between those of figure 1) the shape of the crop profile most close to the farm real situation.

Figure 1. The shape of the crop profiles between those the software ask to identify the one more close to the farm real situation



The software also ask the following information:

- Crop Training system;
- Crop vegetative stage for which the adjustment is reliable;
- Maximum crops height;
- Main target (trunk, leaves, grapes);
- Inter-row distance (m) ;
- Number of rows treated with a single sprayer passage;
- Type and number of nozzles fitted on the sprayer;

- Working pressure (bar);
- Total flow rate (l/min)
- Forward speed (km/h);
- Volume application rate (l/ha);

Data concerning the fan main operative parameters like: type of gear, blades inclination, upper and lower air deflectors positioning (when they are present);

Also in this case several of the mentioned data can be recovered from the functional inspection report. Nevertheless, the technician can discretionally suggest different sprayer settings to achieve better performances. A blank space is also available for further indication the technician consider to be useful for the farmer in order to allow him to appropriate use the sprayer.

As a last step, data concerning the vertical distribution pattern achieved by the use of a vertical patternator are typed into the system. An aid for technicians to choose the most suitable nozzles to achieve the intended distribution pattern is available at the following URL: <http://www.laboratorio-cpt.to.it/diagramma-atomizzatori>. The latter consists in a software that – according to the sprayer and nozzles type – provides in real time the achievable distribution pattern (Tamagnone et al., 2015; Tamagnone et al., 2017).

For each combination - crop type/selected profile – (Table 3 + Figure 1) it's necessary to provide a minimum of two instrumental adjustments (one for young and reduced canopy trees, and a second one for adult and maximum canopy development trees) by filling up further software dedicate space.

Results and conclusions

The software entered into operation in September 2017. So far 176 sprayers (78% of those being air assisted sprayers) were calibrated. A total of 278 setting have been uploaded, 114 of which related to sprayers for vineyards.

The software resulted to be user friendly for technicians and has the advantage of having a simple and easily understandable report as an output. The report – besides the main identification data of both the farm and the sprayer – includes all the main sprayer adjustment suggested and, for air assisted sprayers, the results of the measured vertical distribution patterns. In the following annex is reported an example of the adjustment report to be deliver to the farmer/owner of the sprayer at the end of the adjustment procedure.

References

- AA.VV. Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides.
- Tamagnone M, Calvo A., Savoia S. (2015). Development of a software for supporting the adjustment of vertical spray pattern of air assisted sprayers. *Julius Kuhn Archiv*, 448: 19-20.
- Balsari P., Herbst A., Langenakens J. (2015). Advice for crop sprayers adjustment. ISSN 2364-7574 – DOI 10.5073/spise.en.2015.01
- Balsari P., Herbst A., Langenakens J. (2016). Advice for sprayers for bush and tree crops adjustment. ISSN 2364-7574 – DOI 10.5073/spise.en.2016.01
- Tamagnone M., Calvo A., Godone M. (2017). Adjustment of vertical spray pattern of orchard sprayers with Ve.S.Pa. 2.0 application. Book of Abstracts of Suprofruit 2017 -14th Workshop on Spray Application in Fruit Growing, 45-46

ANNEX



REGOLAZIONE STRUMENTALE IRRORATRICI

(Ai sensi dell'Azione A3.7 del Piano d'Azione Nazionale per l'uso sostenibile dei prodotti fitosanitari - DM 22/01/2014)

RIEPILOGO

FARM INFORMATIONS

AZIENDA

CUAA 02500020066 Partita IVA 02500020066

Denominazione BATETTA CLAUDIO & DEMARTINI LUISELLA SOCIETA' SEMPLICE SOCIETA' AGRICOLA

Indirizzo sede legale VIA SAN GIACOMO 16-LU-AL

PEC BATETTASOC@LEGALMAIL.IT

Mail Telefono

CONTROLLO

Data rilievo 13/02/18

Esito controllo Esito positivo

Rilevatore AMERELLI MASSIMILIANO

Centro di controllo SATA SRL

INSPECTOR AND TEST

MACCHINA

Tipo macchina Atomizzatore o assimilabile - aeroassistita

Marca UNIGREEN

Modello EXPO 6801

Telajo 1870

Anno 2005

SPRAYER INFORMATIONS

UTILIZZO DELLA MACCHINA

Progressivo regolazione	Principali colture trattate	Eventuale valore "altro"	Profilo colture trattate	Eventuale valore "altro"
1	frutta in guscio	HAZELNUT	E - profilo trapezio capovolto - piena vegetazione/piante grandi	
2	frutta in guscio		E - profilo trapezio capovolto - vegetazione ridotta/piante piccole	
3	vite	GRAPEVINE	A - profilo rettangolare - piena vegetazione/piante grandi	
4	vite		A - profilo rettangolare - vegetazione ridotta/piante piccole	

MAIN CROPS

NUMEBER OF ADJUSTMENTS

TREE PROFILE (SEE FIG 1) AND GROWTH STAGE

DATI DI DETTAGLIO DELLE REGOLAZIONI

REGOLAZIONE 1 **ADJUSTMENT 1**

Principale Coltura Trattata

Profilo Coltura Trattata

MAIN OPERATIVE PARAMETERS

Velocità avanzamento (km/h) Portata erogata (l/min)

Pressione di esercizio (bar) Volume distribuito (l/ha)

Numero ugelli Disposizione simmetrica degli ugelli/regolatori di portata

NOZZLES USED

Ugello	Facciata 1	Facciata 2
1	PIASTRINA 1.2 ALBUZ	PIASTRINA 1.2 ALBUZ
2	PIASTRINA 1.2 ALBUZ	PIASTRINA 1.2 ALBUZ
3	PIASTRINA 1.2 ALBUZ	PIASTRINA 1.2 ALBUZ
4	PIASTRINA 1.2 ALBUZ	PIASTRINA 1.2 ALBUZ
5	PIASTRINA 1.2 ALBUZ	PIASTRINA 1.2 ALBUZ
6	PIASTRINA 1.2 ALBUZ	PIASTRINA 1.2 ALBUZ

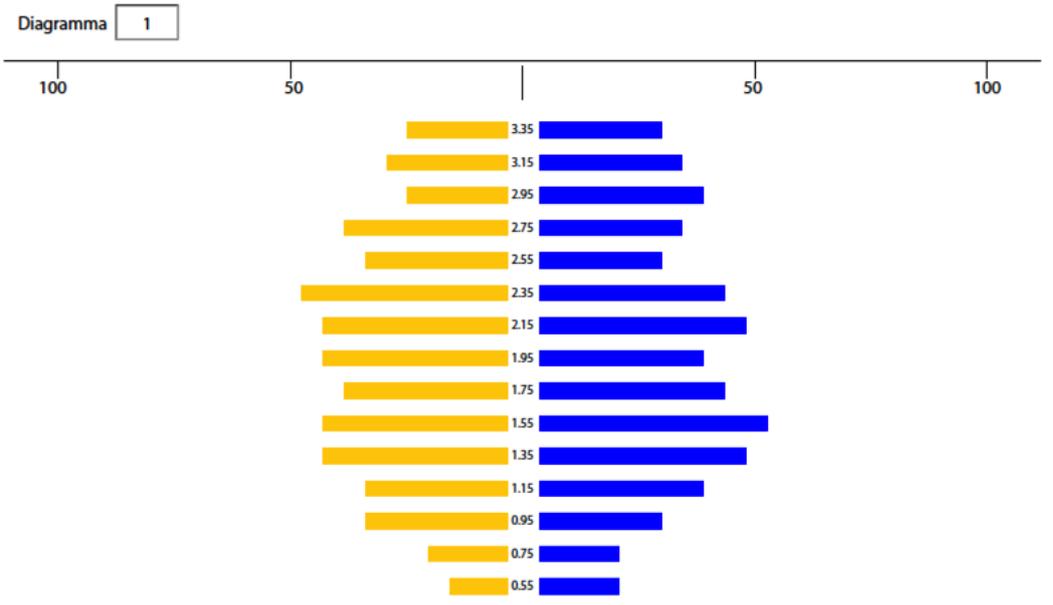
FIELD CONDITIONS

Forma di allevamento Altezza max vegetazione (m)

Epoca vegetativa Filari trattati con unico passaggio (n)

Bersaglio Interfila (m)

Diagramma di distribuzione del liquido **VERTICAL PATTERN**



REGOLAZIONE 3 **ADJUSTMENT 3**

Principale Coltura Trattata

Profilo Coltura Trattata

MAIN OPERATIVE PARAMETERS

Velocità avanzamento (km/h) Portata erogata (l/min)

Pressione di esercizio (bar) Volume distribuito (l/ha)

Numero ugelli Disposizione simmetrica degli ugelli/regolatori di portata

NOZZLES USED

Ugello	Facciata 1	Facciata 2
1	ATR 80 GIALLO	ATR 80 GIALLO
2	ATR 80 GIALLO	ATR 80 GIALLO

FIELD CONDITIONS

Forma di allevamento Altezza max vegetazione (m)

Epoca vegetativa Filari trattati con unico passaggio (n)

Bersaglio Interfila (m)

Diagramma di distribuzione del liquido **VERTICAL PATTERN**

