

## Uniform cross distribution of double flat spray nozzles may be affected by the design of the sprayer

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### Summary

According to EU Directive 2009/128/EC pesticide application equipment must function reliably and be used properly for its intended purpose ensuring that pesticides can be accurately dosed and distributed. The transverse distribution of the spray mixture in the target area must be even, where relevant. Spray jets of double flat spray nozzles are angled forward and backward. Depending on the design of the sprayer and boom height, parts of the equipment get splashed by the angled spray jet. Problems arise with lift masts which are fitted very close to the frame of the sprayer. Solutions might be technical modifications of the boom and tube. If technical changes are not possible, the use of flat spray nozzles on the boom is recommended in the critical area in combination with double flat spray nozzles. Results from sprayer inspection are shown with regard to cross distribution.

Oftentimes, the deepness of the scanner patternator is not suitable in order to catch both spray jets of double flat spray nozzles. An upgrade for Herbst scanner patternator SPRAYERTEST 1000 is available. A modified table HV 1000-L with 2m in depth, which is double of the current one, is introduced to deal with that specific problem. An easy replacement of the patternator table in existing operating equipments is suggested.

**Key words:** Double flat spray nozzles IDKT, cross distribution, mixed mounting of nozzles, longer patternator table

### Introduction

According to EU Directive 2009/128/EC pesticide application equipment must function reliably and be used properly for its intended purpose ensuring that pesticides can be accurately dosed and distributed. Double flat spray air induction nozzles e.g. IDKT are popular and in the meantime well accepted by farmers. Their main characteristic is based on a second spray level with most often symmetric set up. That means one spray jet is directed 30° to the front and the other one 30° backwards in direction of travelling.

The European Norm EN 13790 for Inspection of sprayers in use – Part 1 indicates under point 4.8.6 that “Regardless of the distance of the boom above the ground, no liquid shall be sprayed on the sprayer itself”. Problematic areas are especially frame parts of the sprayer when the boom is mounted close on a lift mast. It might be that only at low spray height the forward directed spray jet is not interfered as it is the case for e.g. herbicide applications. At higher boom heights most certainly the frame of the sprayer gets splashed. Other designs where booms are attached to a parallelogram the distance between boom and frame of the sprayer is much bigger so that at low and mid boom height the spray jets will not hit the sprayer. Only when the parallelogram is extended splashing will occur for e.g. flower treatment in rape seed. If the frame of the sprayer gets splashed, run off of spray liquid occurs. That should be avoided in order to maintain cross distribution and to avoid any point sources into surface water. Not only the frame of the sprayer can be hit by the spray jet but also tires of trailed sprayers when the axle is translocated backwards close to the lift mast. The norm does not apply if parts needed by function, such as, distance guards of booms get splashed and if dripping is minimised.

### Materials and Methods

Cross distribution of new nozzles and already in use have been tested. New nozzles of IDKT 120-04C and IDKN 120-04 POM of each 10 pieces have been measured with a patternator (50 mm groove distance) at Lechler company with a pressure of 2,0 and 4,0 bar at a spray height of 500 mm. Nozzles in use have been tested in a workshop during sprayer inspection. A Holder ES-4 sprayer with 12m boom was equipped with IDKT 120-04C. Additionally, in the mid section of the boom 4 x IDKN 120-04 have been mounted for another series of tests. All measurements have been performed with a Herbst scanner patternator SPRAYERTEST 1000 with a pressure of 3,0 bar at 500 mm spray height.

## Results and Discussion

New IDKT 120-04 and IDKN 120-04 at 2,0 and 4,0 bar showed good performance with a cv of 1,7 to 3,0%. This result is in accordance with JKI requirements for new nozzles allowing a max. cv of 7%.

Tab. 1. Cross distribution of new IDKT 120-04 and IDKN 120-04. Tested on Lechler patterator.

Spray height 500 mm	CV %			
	2,0 bar		4,0 bar	
	IDKT 120-04	IDKN 120-04	IDKT 120-04	IDKN 120-04
	2,1	2,7	1,7	3,0

Nozzles in use have been mounted on a Holder ES-4 sprayer with 12 m boom. Cross distribution was measured with a Herbst scanner patterator SPRAYERTEST 1000. IDKT 120-04C at 500 mm spray height and 3,0 bar pressure obtained a cv of 8,86% (Graph 1). In the mid section of the boom the frame of the sprayer got splashed. Peaks with under and over dosage occurred and are visible on the graph in the test report. But even though cv was below 10% which is the threshold value for rejection of nozzles.

### Holder ES-4, 12m boom (nozzles in use)

Boom: IDKT 120-04C, 3,0 bar



Graph 1. Cross distribution of IDKT 120-04C nozzles in use. Tested on Herbst scanner patterator SPRAYERTEST 1000

By mounting 4 x IDKN 120-04 in the mid section of the boom an improved cross distribution of cv 6,26% was achieved (Graph 2). In the test report no exceeding peaks are seen in the mid section of the boom.

**Holder ES-4, 12m boom (nozzles in use)**

Lateral boom: IDKT 120-04C, 3,0 bar

Middle segment of the boom: 4 x IDKN 120-04, 3,0 bar

- Improved cross distribution
- cv 2,6% better

cv 6,26%



Graph 2. Cross distribution of IDKT 120-04C nozzles in use in combination with 4 x IDKN 120-04 in the mid section of the boom. Tested on Herbst scanner patternator SPRAYERTEST 1000

The European Norm EN 13790 for Inspection of sprayers in use – Part 1 implies under point 4.9.1 that “All nozzles shall be identical (type, size, material and origin) all along the boom, except where they are intended for a special function for example the end nozzles for border spraying. The mixed setting of double flat spray nozzles with flat spray nozzles e.g. in the mid section of the boom is seen as an exception because of technical reasons when other measures do not solve the problem of splashing sprayer parts. Therefore, German JKI approved recently for boom sprayers the mix of IDKT with IDK/IDKN nozzles (Tab. 2). In the mid section of the boom 6 flat spray nozzles are specified which is in accordance with the width of most boom sections.

Tab. 2. JKI approval of IDKT and IDK/IDKN nozzles (20<sup>th</sup> of March 2012)

	Boom	Boom middle section
<b>G 1932</b>	IDKT 120-03 POM	6 x IDKN 120-03 POM
<b>G 1933</b>	IDKT 120-04 POM	6 x IDKN 120-04 POM
<b>G 1934</b>	IDKT 120-05 POM	6 x IDK 120-05 POM

For farmers the combination of IDKT with IDK/IDKN in the mid section of the boom is easy to perform, cheap and with no negative effects on cross distribution (Graph 2). Further advantages are same pressure setting and same drift reduction (Germany). According to EN 13790, the approach uses same type as compact air induction nozzle, same size, same material and same origin.

Most scanner patternators for measurement of cross distribution have a table with 1,00 m in depth. At 500 mm spray height double flat spray nozzles with 30°/30° angling spread around 0,6 m in-between the two spray jets. To catch both spray jets completely on the patternator an exact reverse of the sprayer is necessary in order to bring the boom into a parallel position along the track of the patternator. For Herbst scanner patternator SPRAYERTEST 1000 an upgrade is available. The scanner patternator table HV 1000-L has a depth of 2,00 m which is double of the current one. The replacement takes only 2 minutes. Especially handling of big booms is much easier and spray jets of any double flat spray nozzle is caught easily.

## **Conclusion**

According to EU Directive 2009/128/EC and EN 13790 no liquid shall be sprayed on the sprayer itself. Double flat fan nozzles may splash on sprayer frame under some circumstances. A mixed mounting of IDKT and IDK / IDKN is favourable when technical modifications on the sprayer is not possible or causes high expenses. For farmers it is an easy way to do, cheap and does not influence cross distribution negatively. Oftentimes, the deepness of the scanner patternator is not suitable in order to catch both spray jets of double flat spray nozzles. A modified scanner patternator table HV-1000L of Herbst with 2m in depth is available. Refitting on all SPRAYERTEST 1000 can be done easily.

## **References**

DIN EN 13790-1 Agricultural machinery - Sprayers - Inspection of sprayers in use - Part 1: Field crop sprayers; German version EN 13790-1:2003

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