First evaluation of different pesticides distribution techniques in Piemonte Region hazelnut crops

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G.Oggero[1], M.Tamagnone[1], C.Bozzer[1], S.Savoia[1], M.Corte[2], C.Sonnati[2]

[1]DiSAFA - Dipartimento di Scienze Agrarie Forestali e Alimentari – Università degli Studi di Torino, Grugliasco (TO), ITALY

[2]CReSO - Consorzio di Ricerca, Sperimentazione eDivulgazione per l'Ortofrutticoltura piemontese Sezione corilicola, Cravanzana (CN), ITALY

Introduction

The achievement of high quality hazelnut productions is related to adequate agricultural practices and a correct management of crop protection against the main pests: *Phytoptus avellanae*, *Curculio Nucum*, *Palomena prasina* and *Gonocerus acuteangulatus* (Corte et *al*., 2013). Most of the insecticides used in hazelnut orchards are curative, therefore their action is explicated on populations of parasites already present in the crop, that if not limited, may cause severe economic damages (AliNiazee, 1998). Hazelnut orchards in Piemonte region - which is the third hazelnut producer region in Italy with 15000 hectares (ISTAT 2010) – generally represent an additional crop in vineyard farms and the pesticide application is carried out with the same sprayers used in vineyards, without any sprayer adjustment change. This could lead to ineffective spray distribution on the target and low efficacy of treatments.

With the aim to improve the spray application techniques in hazelnut crop, an ad hoc experimental study was carried out, divided in two parts: part a) assessment of the present quality of spray distribution in some representative hazelnut farms in Piemonte region; part b) evaluation of spray distribution quality applying different volume rates and using two different orchard sprayer models.

Material and Methods

Concerning part a) experiments were carried out in hazelnut plantations located within nine farms that cultivated both vines and hazelnuts trees (cultivar "Tonda Gentile Trilobata" trained at "bush" system, Tab. 1) while part b) trials were made just in farm 9 comparing a conventional farm orchard axial fan sprayer adjustment with an orchard axial fan sprayer Nobili Geo 90 S UT, equipped with a double fan outlet enabling to optimize air distribution, set up to apply three different volume application rates.

Hazel orchard	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 5**	**Farm 6**	**Farm 7**	**Farm 8**	**Farm 9**	
surface (ha)	3.72	2.13	2.25	12.00	1.63	0.22	0.41	7.75	19.42	
total years old	28	20	25	20	30	7	7	23	16	
density (m)	4.5 x 5.5	4.0 x 5.8	3.0 x 6.0	5.0 x 5.0	4.0 x 5.0	5.0 x 5.0	4.5 x 5.5	4.3 x 5.5	5.0 x 6.0	
Sprayer	*test "a"*								*test "a"+ "b"*	*test "b"*
used also in vineyard	yes	yes	yes	yes	yes	yes	yes	no	no[1]	no[2]
nozzles type	disk core	disk core	pneumatic	disk core	disk core	disk core	disk core	disk core	disk core	HCI 80°
nozzles/spouts number	8	8	8	8	8	8	8	5	10	10
working pressure (bar)	18	20	2	22	20	25	20	24	30	12
fan type	axial	axial	centrifugal	axial	axial	axial	axial	centrifugal	axial	axial
pulverisation	hydraulic	hydraulic	pneumatic	hydraulic	hydraulic	hydraulic	hydraulic	hydraulic	hydraulic	hydraulic
speed (km/h)	4.8	4.5	5.5	4.4	4.0	2.8	6.5	4.9	6.0	4.0
volume sprayed (l/ha)	850	950	390	1140	720	620	460	1260	1080	570-930-1400

Tab. 1 – Main characteristics of the hazel orchards and of the sprayers used in the tests.

Results and discussion

Concerning part a), the use of an orchard sprayer (farm 9) enabled to get a more uniform spray deposition on the hazelnut canopies (CV = 33%) and a better spray coverage of the external leaves positioned on the top of the trees, that are more difficult to reach with the spray, even if the average spray deposit resulted low (Tab. 2). On the other hand, vineyard sprayers (employed in farms 1 to 7) provided very high spray deposits on the leaves positioned at the bottom of the

hazelnut canopies but they provided a poor spray coverage of the top of the plants. The average spray deposit resulted lower according to the increase of the spray volume but a high average deposit, especially on plants like hazelnut trees that are not trained as walls, does not guarantee a uniform spray coverage. The relationship between the spray deposit measured on the leaves and the spray volume applied resulted very much influenced by the deposits measured on the external leaves of the canopy, which are easier to reach with the spray and may start to drip, originating ground losses.

			normalized deposit (µl/cm2)							
			external leaves			internal leaves				
Farm/sprayer	***TRV (m3/ha)***	***volume (l/ha)***	1.5 m	2.5 m	4.0 m	1.5 m	2.5 m	4.0 m	***CV***	***average (µl/cm2)***
1	22900	850	1.61	1.40	0.44	0.87	0.72	0.30	58%	0.89
2	2200	950	1.50	1.18	0.45	1.22	1.03	0.16	55%	0.92
3	27400	390	2.39	1.78	1.38	2.28	0.53	0.10	66%	1.41
4	23800	1140	0.92	0.67	0.28	0.53	0.40	0.19	54%	0.50
7	8000	460	2.61	3.01	1.36	0.60	0.75	0.10	83%	1.40
9	27900	1080	0.83	0.67	0.96	0.50	0.50	**0.40**	**33%**	0.65
5	32400	720	3.36	1.77	0.23	1.72	1.13	0.20	84%	1.40
6	7000	620	1.99	1.00	0.33	0.71	0.20	0.01	102%	0.71
8	37700	1260	2.49	2.37	0.16	2.54	2.15	0.22	69%	1.66

Tab. 2 – Comparison between the results obtained in the 9 farms where the experiments were carried out: farms 6 and 8 are listed apart due to the particular spray application technique adopted (only one side oft he row sprayed in farm 6) and to the sprayer pulverisation type (pneumatic. sprayer in farm 8).

Concerning the trials carried out in part b) of the experiment, the orchard sprayer adjustment which considered the application of a volume rate of 930 l/ha resulted the best one. Comparing this result with that obtained using the conventional farm sprayer it was observed that, even if there was not a statistically significant difference in terms of average spray deposit on the target, the orchard sprayer adjusted to apply 930 l/ha (150 l/ha less than the volume usually applied by the farmer) enabled to guarantee a better spray coverage of the internal leaves at the bottom and in the mid part of the canopy trees. In the top part of the trees, instead, the farm sprayer enabled to get higher spray deposits. The Nobili orchard sprayer was nevertheless more efficient in terms of spray penetration in the canopy, especially thanks to the better evenness of the air stream generated by the fan.

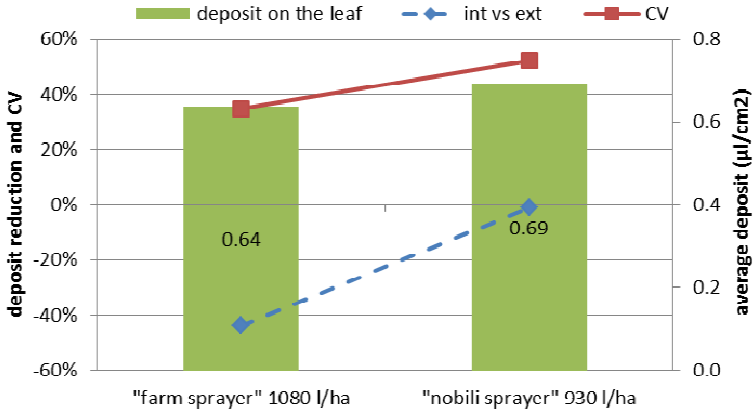

Fig. 1 –Comparison between *farm sprayer* and *nobili sprayer*

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