

## Impact of some technological indicators on weeding and yield in sunflower

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**Abstract** Research was carried out during 2010-2011 and aimed at determining the impact of some weed control measures on both weeding rate and yield in sunflower. The weeds that predominated during the two trial years were: *Chenopodium album*, *Setaria glauca*, *Echinochloa crus-galli*, *Amaranthus retroflexus*, and *Xanthium strumarium*. Weed control rate oscillated between 80.48% and 88.75% in 2010 and between 83.15% and 91.37% in 2011. Absolute yield oscillated between 23.48 q/ha and 30.45 q/ha in 2010 and between 19.09 q/ha and 26.27 q/ha in 2011.

### Key words

sunflower, weeds, share, control rate, yield

Original from Western North America, sunflower is one of the most valuable oily plants cultivated on earth and the most important oily plant in Romania (6).

Sunflower is sensitive to weed competition until the stage of 5 leaf-pairs. During 30-40 days, sunflower should be protected with herbicides and weeding.

The best pre-emergent crops for sunflower are peas, winter wheat, and maize. Sunflower, in its turn, is a good pre-emergent crop because it frees the land early, leaves a small amount of vegetal debris, and the land is left weed free (2).

In establishing the cultivation technology, it is extremely important to establish the control method for annual and perennial weeds without neglecting the choice of hybrids, the sowing time, soil works, fertilisation, and treatments against diseases and pests (4).

The most widespread weeds in sunflower are *Sinapis arvensis*, *Setaria* sp., *Amaranthus* sp., *Chenopodium album*, *Echinochloa crus-galii*, *Hibiscus trionum*, *Centaurea cyanus*, *Cirsium arvense*, *Convolvulus arvensis*, *Sorghum halepense*, *Xanthium* sp., etc. (5, 8).

In order to ensure the best efficacy possible in weed control, we use both simple and compound herbicides. In case of weeding by both monocot and dicot perennial weeds, we need to administer, besides pre-emergent herbicides and post-herbicides (9).

Maintenance works destroy weeds in vegetation through cutting, soil incorporation, fragmentation of vegetative organs and surface exposure, where they exhaust and dehydrate in summer and freeze in winter (1 and 3).

### Material and Method

Trials were set in the trial field of the Cultivation Technologies discipline in 2010-2011.

From the point of view of climate conditions, the two trial years were different. Mean monthly temperatures in the two years during April-August were above multiannual mean. Precipitations were unevenly distributed during vegetation. In 2010, during vegetation, there was accumulation of 102.8 mm above the annual mean, while in 2011 there was a deficit of 82.8 mm.

The sunflower hybrid we cultivated was Splendor, with a vegetation period of 110 days and a yielding potential of 3.6-4.2 t/ha.

Trials were monofactorial, set in randomised blocks with 8 variants and 4 replicas and a total number of 32 trial plots.

Trial variants were:

- V<sub>1</sub> – Not treated, not weeded
- V<sub>2</sub> - Challenger (EC) – 2 l/ha + Pantera 40 EC – 1.75 l/ha
- V<sub>3</sub> - Challenger (EC) – 2 l/ha + Aramo 50 (EC) – 1.5 l/ha
- V<sub>4</sub> - Stomp 330 EC – 5 l/ha + Pantera 40 EC – 1.75 l/ha
- V<sub>5</sub> - Stomp 330 EC – 5 l/ha + Aramo 50 (EC) – 1.5 l/ha
- V<sub>6</sub> - Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha
- V<sub>7</sub> - Dual Gold 960 EC – 1.5 l/ha + Aramo 50 (EC) – 1.5 l/ha
- V<sub>8</sub> - 2 mechanical weeding + 2 manual weeding

Determining the weeding rate was done with the numerical quantitative method per variant and was related to m<sup>2</sup>. Yield was processed according to the STAS.

Processing trial data was done with the variance analysis (7).

## Experimental Results

In 2010, the weeding rate was 178.06 weeds/m<sup>2</sup>. The weeds that predominated were *Echinochloa crus-galli* (18.03%), *Setaria glauca* (15.25%) and *Xanthium strumarium* (14.24%). The following weed species shared below 1%: *Capsella bursa pastoris*, *Convolvulus arvensis*, *Polygonum persicaria*, *Lamium purpureum* and *Agropyron repens* (Table 1).

After administering the herbicides, weed control rate oscillated between 80.48% and 88.75%. The best control results were in the variant treated with

Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha and Stomp 330 EC – 5 l/ha + Pantera 40 EC – 1.75 l/ha, with a weed control rate of 88.75% and 87.64%, respectively. The variant 2 mechanical weeding + 2 manual weeding resulted in a weed control of only 80.48% (Table 2).

Absolute yield oscillated between 23.48 q/ha and 30.45 q/ha. The highest yields, 30.45 q/ha and 29.70 q/ha, were in the variants treated with Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha and Stomp 330 EC – 5 l/ha + Pantera 40 EC – 1.75 l/ha, respectively. Relative yield ranged between 94.11% and 122.04%. The mean of the field was 24.95 q/ha. The variant treated with Challenger (EC) – 2 l/ha + Aramo 50 (EC) – 1.5 l/ha yielded only 23.48 q/ha (Table 3).

Table 1

Natural weeding in sunflower in 2010			
No.	Weed species	Weeds/m <sup>2</sup>	Share %
1	<i>Echinochloa crus-galli</i>	32.10	18.03
2	<i>Setaria glauca</i>	27.15	15.25
3	<i>Xanthium strumarium</i>	25.36	14.24
4	<i>Amaranthus retroflexus</i>	23.04	12.94
5	<i>Chenopodium album</i>	22.17	12.45
6	<i>Sorghum halepense</i>	17.02	9.56
7	<i>Hibiscus trionum</i>	13.16	7.39
8	<i>Cirsium arvense</i>	8.05	4.52
9	<i>Polygonum convolvulus</i>	4.12	2.31
10	<i>Solanum nigrum</i>	2.76	1.55
11	<i>Sinapis arvensis</i>	1.75	0.98
12	<i>Capsella bursa pastoris</i>	0.82	0.46
13	<i>Convolvulus arvensis</i>	0.32	0.16
14	<i>Polygonum persicaria</i>	0.12	0.08
15	<i>Lamium purpureum</i>	0.08	0.04
16	<i>Agropyron repens</i>	0.04	0.02
	<b>TOTAL</b>	<b>178.06</b>	<b>100.00</b>

Table 2

## Synthesis of trial results regarding weeding rate in sunflower in 2010

Variant	Weeds/m <sup>2</sup>	Weed control rate (%)	Difference to control	Significance of difference
V <sub>6</sub> - Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha	20.92	88.75	-157.14	000
V <sub>4</sub> - Stomp 330 EC – 5 l/ha + Pantera 40 EC – 1.75 l/ha	22.01	87.64	-156.05	000
V <sub>7</sub> - Dual Gold 960 EC – 1.5 l/ha + Aramo 50 (EC) – 1.5 l/ha	22.85	87.17	-155.21	000
V <sub>5</sub> - Stomp 330 EC – 5 l/ha + Aramo 50 (EC) – 1.5 l/ha	26.25	85.26	151.81	000
V <sub>2</sub> - Challenger (EC) – 2 l/ha + Pantera 40 EC – 1.75 l/ha	28.01	84.27	-150.05	000
V <sub>3</sub> - Challenger (EC) – 2 l/ha + Aramo 50 (EC) – 1.5 l/ha	32.94	81.50	145.12	000
V <sub>8</sub> - 2 mechanical weeding + 2 manual weeding	34.76	80.48	-143.30	000
V <sub>1</sub> - Not treated, not weeded	178.06	0.00	Mt.	-

DL<sub>5%</sub> = 6.35 weeds/m<sup>2</sup>DL<sub>1%</sub> = 9.48 weeds/m<sup>2</sup>DL<sub>0.1%</sub> = 15.03 weeds/m<sup>2</sup>

Table 3

## Synthesis of trial results regarding weeding rate in sunflower in 2010

Variant	Absolute yield (q/ha)	Relative yield (%)	Difference in yield (q/ha)	Significance of difference
V <sub>6</sub> - Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha	30.45	122.04	+5.50	xx
V <sub>4</sub> - Stomp 330 EC – 5 l/ha + Pantera 40 EC – 1.75 l/ha	29.70	119.04	+4.75	xx
V <sub>7</sub> - Dual Gold 960 EC – 1.5 l/ha + Aramo 50 (EC) – 1.5 l/ha	27.64	110.78	+2.69	-
V <sub>5</sub> - Stomp 330 EC – 5 l/ha + Aramo 50 (EC) – 1.5 l/ha	27.27	109.30	+2.32	-
V <sub>8</sub> - 2 mechanical weeding + 2 manual weeding	26.73	107.13	+1.78	-
V <sub>2</sub> - Challenger (EC) – 2 l/ha + Pantera 40 EC – 1.75 l/ha	25.04	100.36	+0.09	-
<b>X - media</b>	<b>24.95</b>	<b>100.00</b>	<b>Mt.</b>	-
V <sub>3</sub> - Challenger (EC) – 2 l/ha + Aramo 50 (EC) – 1.5 l/ha	23.48	94.11	-1.47	-
V <sub>1</sub> - Not treated, not weeded	9.26	37.11	-15.69	000

DL<sub>5%</sub> = 3.15 q/haDL<sub>1%</sub> = 4.60 q/haDL<sub>0.1%</sub> = 6.52 q/ha

In 2011, weeding rate was lower than in 2010, i.e. only 120.50 weeds/m<sup>2</sup>. The most widespread weed species were *Chenopodium album* (22.49%), *Setaria glauca* (20.78%), *Amaranthus retroflexus* (16.72%) and *Echinochloa crus-galii* (14.41%). The weed species *Sorghum halepense*, *Cirsium arvense*, *Polygonum persicaria*, *Polygonum convolvulus* and *Lamium purpureum* shared less than 1% (Table 4).

Weed control rate depending on the weed control method oscillated between 83.15% and 91.37%. The best results were in the variants treated with Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha and Dual Gold 960 EC – 1.5 l/ha + Aramo 50 (EC) – 1.5 l/ha, with a weed control rate of 91.37% and 90.05%, respectively. The variant 2 mechanical weeding + 2 manual weeding resulted in a weed control rate of 86.42% (Table 5).

Table 4

No.	Weed species	Weeds/m <sup>2</sup>	Share %
1.	<i>Chenopodium album</i>	27.10	22.49
2.	<i>Setaria glauca</i>	25.04	20.78
3.	<i>Amaranthus retroflexus</i>	20.15	16.72
4.	<i>Echinochloa crus-galii</i>	17.36	14.41
5.	<i>Xanthium strumarium</i>	12.04	9.99
6.	<i>Convolvulus arvensis</i>	9.06	7.52
7.	<i>Hibiscus trionum</i>	5.17	4.29
8.	<i>Capsella bursa pastoris</i>	2.10	1.74
9.	<i>Sinapis arvensis</i>	1.24	1.02
10.	<i>Sorghum halepense</i>	0.72	0.60
11.	<i>Cirsium arvense</i>	0.24	0.20
12.	<i>Polygonum persicaria</i>	0.12	0.10
13.	<i>Polygonum convolvulus</i>	0.08	0.07
14.	<i>Lamium purpureum</i>	0.08	0.07
	<b>TOTAL</b>	<b>120.50</b>	<b>100.00</b>

Table 5

Variant	Weeds/m <sup>2</sup>	Weed control rate (%)	Difference to control	Significance of difference
V <sub>6</sub> - Dual Gold 960 EC – 1,5 l/ha + Pantera 40 EC – 1,75 l/ha	10.40	91.37	-110.10	000
V <sub>7</sub> - Dual Gold 960 EC – 1,5 l/ha + Aramo 50 (EC) – 1,5 l/ha	11.99	90.05	-108.51	000
V <sub>5</sub> - Stomp 330 EC – 5 l/ha + Aramo 50 (EC) – 1,5 l/ha	13.70	88.63	-106.80	000
V <sub>4</sub> - Stomp 330 EC – 5 l/ha + Pantera 40 EC – 1,75 l/ha	14.32	88.12	-106.18	000
V <sub>8</sub> - 2 mechanical weeding + 2 manual weeding	16.36	86.42	-104.14	000
V <sub>3</sub> - Challenger (EC) – 2 l/ha + Aramo 50 (EC) – 1,5 l/ha	18.94	84.28	-101.56	000
V <sub>2</sub> - Challenger (EC) – 2 l/ha + Pantera 40 EC – 1,75 l/ha	20.30	83.15	-100.20	000
V <sub>1</sub> – Not treated, not weeded	120.50	0.00	Mt.	-

DL<sub>5%</sub> = 3.87 weeds/m<sup>2</sup>  
 DL<sub>1%</sub> = 5.64 weeds/m<sup>2</sup>  
 DL<sub>0.1%</sub> = 8.73 weeds/m<sup>2</sup>

Absolute yield oscillated between 19.09 q/ha and 26.27 q/ha. The highest yields, 26.27 q/ha and 25.16 q/ha, were obtained in the variants treated with Dual Gold 960 EC – 1.5 l/ha + Aramo 50 (EC) – 1.5 l/ha and Stomp 330 EC – 5 l/ha + Aramo 50 (EC) – 1.5 l/ha, respectively. Relative yield ranged between

91.32% and 125.93%. The mean of the field was 20.86 q/ha. The variants treated with Challenger (EC) – 2 l/ha associated with Pantera 40 EC – 1.75 l/ha or Aramo 50 (EC) – 1.5 l/ha yielded below the mean of the field (Table 6).

Table 6

Synthesis of trial results regarding weeding rate in sunflower in 2011

<i>Variant</i>	<i>Absolute yield (q/ha)</i>	<i>Relative yield (%)</i>	<i>Difference in yield (q/ha)</i>	<i>Significance of difference</i>
V <sub>7</sub> - Dual Gold 960 EC – 1,5 l/ha + Aramo 50 (EC) – 1.5 l/ha	26.27	125.93	+5.41	xxx
V <sub>5</sub> - Stomp 330 EC – 5 l/ha + Aramo 50 (EC) – 1.5 l/ha	25.16	120.61	+4.30	xx
V <sub>6</sub> - Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha	24.06	115.34	+3.20	x
V <sub>4</sub> - Stomp 330 EC – 5 l/ha + Pantera 40 EC – 1.75 l/ha	22.15	106.18	+1.29	-
V <sub>8</sub> - 2 mechanical weedings + 2 manual weedings	21.48	102.97	+0.62	-
<b>X - mean</b>	<b>20.86</b>	<b>100.00</b>	<b>Mt.</b>	-
V <sub>2</sub> - Challenger (EC) – 2 l/ha + Pantera 40 EC – 1.75 l/ha	20.34	97.51	-0.52	-
V <sub>3</sub> - Challenger (EC) – 2 l/ha + Aramo 50 (EC) – 1.5 l/ha	19.09	91.32	-1.81	-
V <sub>1</sub> – Not treated, not weeded	8.40	40.27	-12.46	000

DL<sub>5%</sub> = 2.75 q/ha

DL<sub>1%</sub> = 3.80 q/ha

DL<sub>0.1%</sub> = 5.37 q/ha

## Conclusions

Research results allow us to draw the following conclusions:

1. The weeds that predominated in 2010 were *Echinochloa crus-galli* (18.03%), *Setaria glauca* (15.25%) and *Xanthium strumarium* (14.24%). In 2011, the species most widespread were *Chenopodium album* (22.49%), *Setaria glauca* (20.78%), *Amaranthus retroflexus* (16.72%) and *Echinochloa crus-galli* (14.41%).
2. The weed control rate oscillated between 80.48% (2 mechanical weedings + 2 manual weedings) and 88.75% (Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha) in 2010 and between 83.15% (Challenger (EC) – 2 l/ha + Pantera 40 EC – 1.75 l/ha) and 91.37% (Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha) in 2011.
3. Absolute yield oscillated between 23.48 q/ha (Challenger (EC) – 2 l/ha + Aramo 50 (EC) – 1.5 l/ha) and 30.45 q/ha (Dual Gold 960 EC – 1.5 l/ha + Pantera 40 EC – 1.75 l/ha) in 2010 and between 19.09 q/ha (Challenger (EC) – 2 l/ha + Aramo 50 (EC) – 1.5 l/ha) and 26.27 q/ha (Dual Gold 960 EC – 1.5 l/ha + Aramo 50 (EC) – 1.5 l/ha) in 2011.

4. The mean of the field was 24.95 q/ha in 2010 and 20.86 q/ha in 2011.

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