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EFFECTIVENESS OF SOME HERBICIDES AND HERBICIDE COMBINATIONS APPLIED TO CHICKPEA (*Cicer arietinum* L.) CULTURE

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ABSTRACT

The purpose of this work is to establish the effectiveness of herbicides or combinations of herbicides under the influence of different climatic conditions in the study years (2019-2021). In this regard, ARDS Teleorman has established an experiment with the application of herbicides and combinations of herbicides, applied in different doses, in different application periods, placed according to the method of randomized blocks in three repetitions, on a chernozem cambic soil with clay content over 42%. The Burnas variety, a chickpea variety created by ARDS Teleorman, was used. Based on the frequency, the following specific problems were identified: *Digitaria sanguinalis, Echinochloa crus-galli, Setaria* spp., *Amaranthus retroflexus, Chenopodium album, Solanum nigrum, Hibiscus trionum, Polygonum convolvulus, Sinapis arvensis, Stellaria media, Veronica* spp., *Xitalicum Cirsium arvense, Convolvulus arvensis, Sonchus arvensis*. On average, over the three years of experimentation, the combination of herbicides applied to the V8 variant [312.5 g/l S-metolaclor; 87.5 g/l terbutilazin applied in a dose of 4.0 l/ha in pre-emergence + isoxaflutol 240 g/l Ciprosulfamida (safener): 240 g/l applied in a dose of 0.3 l/ha in pre-emergence] 98%, variant V5 [960 g/l S-metolaclor isoxaflutol 240 g/l applied in a dose of 1.2 l/ha in pre-emergence + isoxaflutol 240 g/l Ciprosulfamida (safener): 240 g/l in a dose of 0.2 l/ha in pre-emergence] 96.4% and in variant V3 [50g/l quizalofop-p-ethyl at a dose of 1.2 l/ha post-emergence + isoxaflutol 240 g/l Ciprosulfamida (safener): 240 g/l at a dose of 0.15 l/ ha post-emergence] 96%. Of all the tested variants, the variant with the application of 312.5 g/l S-metolaclo; 187.5 g/l terbutilazin herbicides (4.0 l/ha) + isoxaflutol 240 g/l; Ciprosulfamida (safener): 240 g/l (0.3 l/ha) in pre-emergence, with a high level of production, which does not allow its recommendation in weed control in chickpeas.

Keywords: chickpeas, herbicides, weeds, control, efficacy.

INTRODUCTION

In order to maintain and increase the fertility of the soil, a rational crop rotation is necessary, which should not lack legume crops. In areas with frequent drought, the most resistant of annual legumes is chickpeas (*Cicer arietinum* L.). It has the ability to cease its activity during periods of water stress when it resumes when favorable conditions occur, without thereby significantly influencing the level of production.

In Romania, chickpeas are a "niche" crop whose share in the structure of agricultural plants is low, which is why there are no approved herbicides, which makes it very difficult to control weeds. Weed control is most successful in complex application of agrotechnical and chemical methods (Şanlı et al., 2009; Ratnam and Rao, 2011). World experience shows that the possibilities for biological weed control are still small (Vaissi and Shimi, 2003). Agro-technical methods include: crop rotation - sowing of legumes after cereals; plowing and pre-sowing tillage adjusted to character and degree of weed infestation; adherence to the chickpea sowing period, etc. Chemical control is carried out with selective herbicides - soil-applied and foliar applied. They should be selected according to the nature of the weed associations accompanying the chickpea crop (Skrobakova, 1998; Khan et al., 2010; Tanveer et al., 2010; Delchev, 2020).

Chickpea yield losses due to weed competition have been estimated to range between 40 and 87% depending on weed species and density (Bhan and Kukula, 1987).

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Results from experimental work conducted in India, Italy, and Australia indicate that pre-emergence herbicides generally gave better weed control than postemergence herbicides and did not cause plant damage (Mahoney, 1981; Mittal and Singh, 1983; Yadav et al., 1983; Mahoney, 1984a, 1984b; Calcagno et al., 1987; Kumar et al., 1989; Ramakrishna et al., 1992).

The purpose of this work is to establish the effectiveness of herbicides or herbicide combinations on chickpea crops under the influence of different climatic conditions in the study years (2019-2021).

MATERIAL AND METHODS

The research has been carried out in the years 2019-2021, under conditions of ARDS Teleorman (lat 44°07`; long. 25°45`; alt 75 m), being studied the combinations and associations of herbicides applied to chickpea culture.

Experimental design

The experiment was located on a soil of chernozem vertric type with good fertility (over 3.1% humus, clay content over 42% in the horizon 0-24 cm, pH>5.9), using the variety of chickpeas Burnas. The experiment was performed according to the method of randomized blocks, with a plot area of 25 m^2, in four repetitions.

The calculation and interpretation of the results was made based on the analysis of the variance of the experiments placed in the subdivided plots.

Active substances of herbicides and their doses are shown in Table 1.

Table 1. Investigated variants

No.	Variants	Active substance	Doses	Application period
1	Untreated	Control 1	-	-
2	2 mechanical hoeing	Control 2	-	-
3	Leopard 50EC	50 g/l quizalofop-p-ethyl	1.20 l/ha	Postem.
	Merlin Flex	isoxaflutol 240 g/l Ciprosulfamida (safener): 240 g/l	0.15 l/ha	Postem.
4	Dual Gold 960EC	960 g/l S-metolaclor isoxaflutol 240 g/l	1.5 l/ha	Preem.
	Merlin Flex	isoxaflutol 240 g/l Ciprosulfamida (safener): 240 g/l	0.2 l/ha	Preem.
5	Dual Gold 960EC	960 g/l S-metolaclor isoxaflutol 240 g/l	1.2 l/ha	Preem.
	Merlin Flex	isoxaflutol 240 g/l Ciprosulfamida (safener): 240 g/l	0.3 l/ha	Preem.
6	Gardoprim Plus Gold 500 SC	312.5 g/l S-metolaclor 187.5 g/l terbutilazin	4.0 l/ha	Preem.
7	Gardoprim Plus Gold 500 SC	312.5 g/l S-metolaclor 187.5 g/l terbutilazin	4.0 l/ha	Preem.
	Merlin Flex	isoxaflutol 240 g/l Ciprosulfamida (safener): 240 g/l	0.20 l/ha	Preem.
8	Gardoprim Plus Gold 500 SC	312.5 g/l S-metolaclor 187.5 g/l terbutilazin	4.0 l/ha	Preem
	Merlin Flex	isoxaflutol 240 g/l Ciprosulfamida (safener): 240 g/l	0.30 l/ha	Preem
9	Gardoprim Plus Gold 500 SC	312.5 g/l S-metolaclor 187.5 g/l terbutilazin	4.0 l/ha	Preem.
	Lentagran	piridat 450 g/kg	1.0 l/ha	Post. I
	Lentagran	piridat 450 g/kg	1.0 l/ha	Post. II
10	Dual Gold 960EC	960 g/l S-metolaclor	1.5 l/ha	Preem.
	Challenge 600 SC	aclonifen	2.5 l/ha	Preem.
11	Dual Gold 960EC	960 g/l S-metolaclor	1.5 l/ha	Preem.
	Pulsar 40	40 gr/l imazamox	0.7 l/ha	Post.
12	Dual Gold 960EC	960 g/l S-metolaclor	1.5 l/ha	Preem.
	Sencor 600 SC	metribuzin 700 g/kg	0.3 l/ha	Preem.

Crop management

The preceding crop was winter wheat. After harvesting the preceding crop, there was performed a harrowing work, and after that the ploughing was performed at a depth of 30 cm. In the autumn, 100 kg of nitrocalcar (27% nitrogen) were applied, being incorporated into the soil with the disc harrow work. In the spring, complex chemical fertilizers of the 15:15:15 type were applied, in a dose of 300 kg commercial product on ha. For the preparation of the germination bed, two perpendicular works made with a combinator were performed. After preparing the germination bed, was sown with the SPC seed drill.

Climatic data

In terms of temperature in the experimental years (2019-2021), chickpea benefited throughout the vegetation period from temperatures higher than the multiannual average (Figure 1).

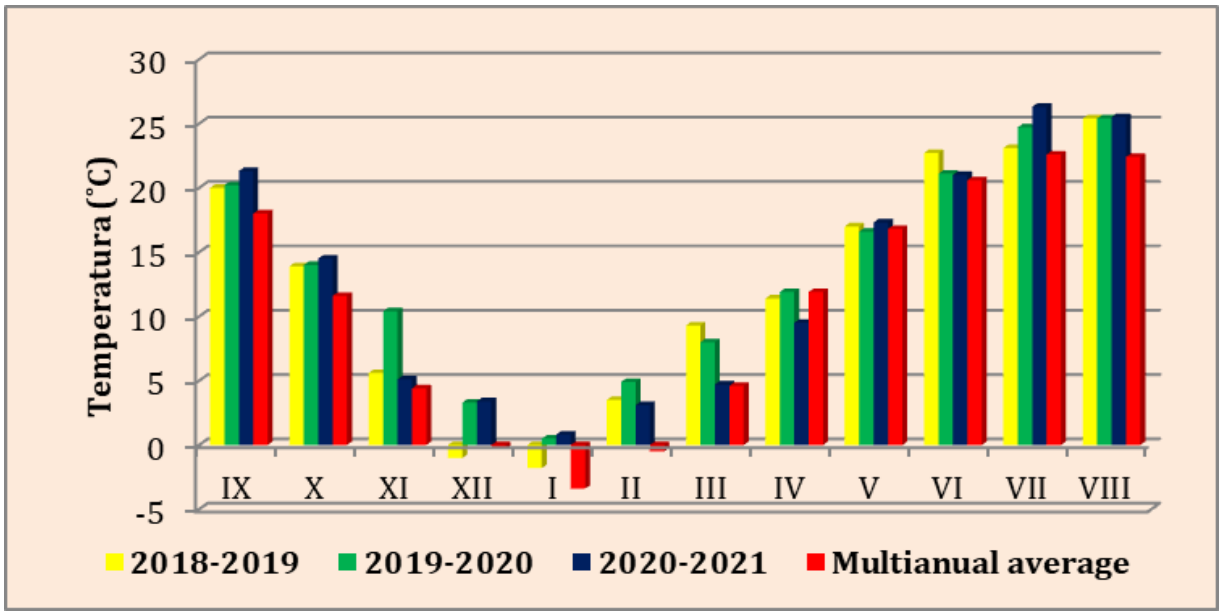

Figure 1. Evolution of average monthly temperatures at ARDS Teleorman in the years 2019-2021

In terms of water, in 2019, chickpeas benefited from 376.6 mm of rainfall over the entire vegetation period, being 76.6 mm more than the crop's requirements for humidity, but their distribution was unfavourable to chickpeas.

Thus, in the first part of the vegetation period the precipitations were quantitatively higher than the multiannual average with 27.2 mm in April, 48.1 mm in May and 99.3 mm in June. During the of harvest formation stage, there was an accentuated water deficit in July (27.1 mm) and August (-47.2 mm), a month in which no precipitation was registered (Figure 2).

In 2020, there were excess rainfall in May (+7.8 mm) and June (+11.6 mm) and deficit in April (-21.8 mm), July and August (cumulative -92.9) mm), compared to the multiannual averages of the area (Figure 2).

In July, it can be said that the total drought was installed, only 2.8 mm of rainfall was recorded, the rainfall being practically absent, the deficit of the month being 58.6 mm, and in August 12.6 mm, of which 12.2 mm in the second decade, and the deficit was 34.4 mm.

The abundant precipitations from May and June 2019, in the presence of relatively high temperatures, had an unfavorable influence on the foliar apparatus through the explosion of foliar diseases, implicitly reducing the assimilation surface of the plants. As a result, the yields obtained are low compared to the genetic capacity, the values of useful agronomic indicators (weight of 1000 seed

and hectolitre mass) do not live up to expectations.

In April 2021, 36.0 mm of rain were recorded, of which 23.0 mm in the second decade, the deficit being 21.8 mm, but allowed a relatively good emergence of chickpeas, which requires a greater amount of water for seed germination, but not excessive as it may cause their mold in the soil.

In May and June, 83.0 mm and 99.0 mm fell, respectively, with a total surplus of 47.0 mm, causing a relatively normal growth of chickpeas. In July, it can be said that total drought was installed, only 1.0 mm of precipitation was recorded, precipitation being practically absent, the deficit of the month being 59.9 mm, and in August 36.0 mm, of which 34.0 mm in the third decade, on August 30, and the deficit was 10.8 mm. The lack of precipitation in July and August, but against the background of a good reserve in May and June, had a less negative influence on chickpeas, although they were in the phenophases of the formation of elements of productivity, grain filling and physiological or technical maturity, followed by harvesting (Figure 2).

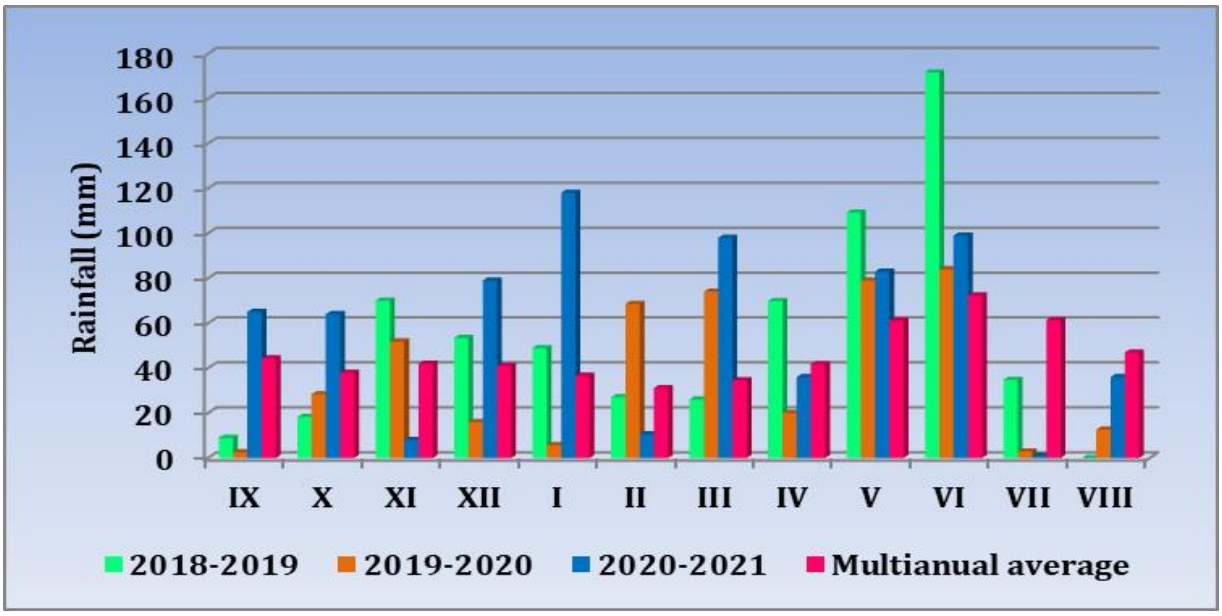

Figure 2. Evolution of rainfall at ARDS Teleorman in the years 2019, 2020 and 2021

The herbicide treatments, mentioned in Table 1, were applied: pre-emergent and post-emergent, in the stage of 10-12 cm height at the chickpea plant and the growth stage of monocotyledonous (BBCH 11-14) and dicotyledonous (BBCH 11-15) weeds.

After the application of herbicide treatments, were made observations for the degree of selectivity (%) at intervals of 7 - 14 - 28 days after treatment and the effectiveness of weed control (%) at the interval of 14 and 28 days after treatment.

During the research, specific determinations were made to establish the degree of weeding, weeding characteristics, effectiveness of tested control strategies and herbicide phytotoxicity.

Determinations regarding the weeding characteristics specific to chickpeas in the study area: determination of the annual and average weeding degree (numerical and gravimetric), for chickpeas cultivated in the ARDS Teleorman area.

RESULTS AND DISCUSSION

As part of the chickpea experiment located in the experimental field at ARDS Teleorman, the culture presented a high degree of infestation with annual monocotyledonous and dicotyledonous weeds, depending on the local pedoclimatic conditions, of the years 2019-2021.

The most common species of annual monocotyledonous weeds: *Echinochloa crus-galli*, *Setari*a spp., *Avena fatua* and annual dicotyledons: *Amaranthus retroflexus*, *Chenopodium album*, *Chenopodium polyspermum*, *Hibiscus trionum*, *Polygonum convolvulus*, *Sinapis arvensis*, *Stellaria media*, *Veronica* spp., *Xanthium italicum*, as well as perennials: *Cirsium arvense*, *Convolvulus arvensis*, *Sonchus arvensis* (Table 2).

Table 2. The structure of the segetal flora from the chickpea culture studied

No	Species	Average pl/m^2			Participation %		
		2019	2020	2021	2019	2020	2021
1	*Digitaria sanguinalis (ma)*	1.0	18.5	12.0	0.8	14.7	9.5
2	*Echinochloa crus-galli (ma)*	18.0	31.7	15.0	14.1	25.2	11.9
3	*Setaria* spp. *(ma)*	18.5	14.5	16.5	14.5	11.5	13.1
4	*Amaranthus retroflexus (da)*	14.5	12.5	8.0	11.4	9.9	6.3
5	*Chenopodium album (da)*	31.7	3.0	7.0	24.9	2.4	5.5
6	*Solanum nigrum (da)*	2.7	1.2	2.0	2.1	1.0	1.6
7	*Hibiscus trionum (da)*	5.5	7.0	8.0	4.3	5.6	6.3
8	*Polygonum convolvulus (da)*	7.2	7.6	26.0	6.0	6.0	20.6
9	*Sinapis arvensis (da)*	0.7	5.5	4.0	0.5	4.4	3.2
10	*Stellaria media (da)*	1.4	1.2	1.5	1.1	1.0	1.2
11	*Veronica* spp.(*da)*	1.2	2.7	4.0	0.9	2.2	3.2
12	*Xanthium italicum (da)*	7.0	7.6	3.5	5.5	6.0	2.8
13	*Cirsium arvense (dp)*	4.6	4.0	2.4	3.6	3.1	1.9
14	*Convolvulus arvensis (dp)*	11.0	6.4	13.2	8.6	5.0	10.5
15	*Sonchus arvensis (dp)*	2.2	2.4	3.1	1.7	2.0	2.5
Total		**127.2**	**125.8**	**137.0**	**100**	**100**	**100**
Annual monocotyledons		37.5	64.7	43.5	29.4	51.4	34.5
Perennial monocotyledons		-	-		-	-	
Annual dicotyledons		71.9	48.3	64.0	56.5	38.3	50.7
Perennial dicotyledons		17.8	12.8	18.7	13.9	10.1	14.8

The following problem species were identified on the basis of frequency: *Digitaria sanguinalis*, *Echinochloa crus-galli*, *Setaria* spp., *Amaranthus retroflexus*, *Chenopodium album*, *Solanum nigrum*, *Hibiscus trionum*, *Polygonum convolvulus*, *Sinapis arvensis*, *Stellaria media*, *Veronica* spp., *Xanthium italicum*, *Cirsium arvense*, *Convolvulus arvensis*, *Sonchus arvensis.*

It can be seen, analyzing Table 2, that the structure of the segetal flora is different for the three years of study and is influenced by cultural techniques, but mostly by the climatic conditions of that year.

Thus, in 2019 the annual dicotyledonous weeds had the largest share (56.5%), in 2020 the annual monocotyledons (51.4%), and in 2021 the annual dicotyledonous weeds (50.7%).

By species, the highest participation was in *Chenopodium album* (24.9%) in 2019, *Echinochloa crus-galli* (25.2%) in 2020 and *Polygonum convolvulus* (20.6%) in 2021.

Under these infestation conditions, the application of herbicides and herbicide combinations to the control effect of monocotyledonous and dicotyledonous weed species, depending on the degree of infestation, the spectrum and the dominance of the species present in chickpeas, has been obtained. the influence of climatic conditions (precipitation recorded before and after treatment).

Table 3. Degree of weed control according to the applied treatments

No	Variants	Selectivity EWRS	Percentage of weeds controlled - 28 days Effectiveness (%)				Note EWRS	Appreciation
			2019	2020	2021	Average		
1	Control 1 - Unhoeing	-	0	0	0	Mt	**9**	**NS**
2	Control 2 - 2 mechanical hoeing	-	92	94	97	94.3	**3.0**	**B**
3	Leopard 50EC + Merlin Flex	**1**	92	98	98	**96.0**	**2.9**	**FB**
4	Dual Gold 960EC + Merlin Flex (1.5+0.2 l/ha)	**1**	94	98.4	94	95.4	**3.0**	**B**
5	Dual Gold 960 EC + Merlin Flex (1.5+0.2 l/ha)	**1**	95	97	97.3	**96.4**	**2.8**	**FB**
6	Gardoprim Plus Gold 500 SC	**1**	89	90	92	90.3	**3.7**	**B/S**
7	Gardoprim Plus Gold 500 SC + Merlin Flex (4.0+0.2 l/ha)	**1**	91	93	95	93.0	**3.0**	**B**
8	Gardoprim Plus Gold 500 SC + Merlin Flex (4.0+0.2 l/ha)	**1**	**96**	**99**	**99**	**98.0**	**2.5**	**FB**
9	Gardoprim Plus Gold 500 SC + Lentagran +Lentagran	**1**	89	95	96	93.3	**3.0**	**B**
10	Dual Gold 960EC + Challenge 600 SC	**1**	87	89	89	88.3	**3.7**	**B/S**
11	Dual Gold 960EC + Pulsar 40	**4**	75	80	83	79.3	**4.5**	**NS**
12	Dual Gold 960EC + Sencor 600 SC	**1**	86	87	89	87.3	**4.0**	**NS**

FB = very good effect; B = good effect; S = satisfactory effect; NS = unsatisfactory.

At 28 days of treatment, notes were made on the selectivity and effectiveness of the herbicides applied. Herbicide selectivity was rated according to the EWRS scale with grades 1 to 9 (grade 1 - no damage, grade 9 - crop is completely destroyed). On average, during the years of experimentation, the only experimental variant that showed traces of phytotoxicity was variant 11 (Dual Gold 960 EC in a dose of 1.5 l/ha applied pre-emergent + Pulsar 40 in a dose of 0.7 l/ha applied post-emergent) (Table 3).

Regarding the percentage of weeds controlled (efficacy) at 28 days of treatment it can be seen that differences between the experimental years, at the same variant, is not very large where. So, we can conclude that the climatic factor did not decisively influence the efficacy of the products applied. On average, over the three years of experimentation, the combination of herbicides applied to the V8 variant (Gardoprim Plus Gold 500 SC applied in a dose of 4.0 l/ha in pre-emergence + Merlin Flex applied in a dose of 0.3 l/ha in pre-emergence) 98%, variant V5 (Dual Gold 960 EC applied in a dose of 1.2 l/ha in pre-emergence + Merlin Flex in a dose of 0.2 l/ha in pre-emergence) 96.4% and in variant V3 (Leopard 50 EC at a dose of 1.2 l/ha post-emergence + Merlin Flex at a dose of 0.15 l/ha post-emergence) 96%.

The lowest efficacy was the herbicide combinations applied to the V12 variants (Dual Gold 960 EC applied at a dose of 1.5 l/ha pre-emergent + Sencor 600 SC applied at a dose of 0.3 l/ha pre-emergent) 79.3% and V11 (Dual Gold 960 EC applied at a dose of 1.5 l/ha pre-emergence + Pulsar 40 applied at a dose of 0.7 l/ha post-emergence) 87.3% (Table 3).

The productions obtained in the three years of experimentation were influenced by the application of herbicides and herbicide combinations, by their effectiveness and selectivity. The average yields obtained are closely correlated with the evolution of climatic factors and the degree of weed control.

Thus, in 2019, in the case of pre-emergence applications, the highest level of production was reached when applying the treatment with herbicides Gardoprim Plus Gold 500 SC + Merlin Flex, with a very significant increase in production, statistically assured, of 1089 kg/ha compared to Co. 1 and 76 kg/ha compared to Co. 2, not statistically assured, and in the case of post-emergent control for treatments

with Leopard 50 EC + Merlin Flex (V3), the increase was very significant, statistically assured, of 791 kg/ha compared to Co.1 (Table 4).

In 2020, compared to Co.1, all experimental variants had production increases, when applying herbicides and herbicide combinations, very significant, statistically assured, and compared to Co.2 a very significant increase in production, statistically assured (246 kg/ha) was obtained when applying Gardoprim Plus Gold 500 SC + Merlin Flex (V8) herbicide treatment. In post-emergency treatments with Leopard 50 EC + Merlin Flex (V3) herbicides, a distinctly significant increase in production was obtained (186 kg/ha). By applying the Gardoprim Plus Gold 500 SC + Merlin Flex (V7) herbicide combination, a significant increase in production (115 kg/ha) was obtained compared to Co.2 (Table 4).

Table 4. The influence of herbicide combinations on chickpea yields

No.	Average yield kg/ha			Relative yield compared to Co.1 (%)			Relative yield compared to Co.2 (%)			Difference ± Co.1 (kg/ha)			Difference ± Co.2 (kg/ha)			Significance					
																compared to Co.1			compared to Co.2		
	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021	2019	2020	2021
V1	397	564	609	100	100	100	28.17	31.94	33.83	Co	Co	Co	-1013	-1201	-1191	Co	Co	Co	000	000	000
V2	1411	1765	1799	355.03	313.07	295.62	100	100	100	+1013	+1201	+1191	Co	Co	Co	***	***	***	Co	Co	Co
V3	1188	1950	1981	298.99	346.01	325.52	84.22	110.52	110.11	+791	+1387	+1373	-223	*+186*	+182	***	***	***	000	**	**
V4	1143	1680	1785	287.58	298.05	293.26	81.00	95.20	99.20	+745	+1116	+1176	-268	-85	-14	***	***	***	000		
V5	1243	1761	1955	312.84	312.36	321.25	88.11	99.77	108.67	+846	+1197	+1347	-168	-4	+156	***	***	***	00		**
V6	1060	1520	1626	266.69	269.66	267.14	75.12	86.14	90.37	+662	+956	+1017	-351	-245	-173	***	***	***	000	000	00
V7	1191	1880	1685	299.66	333.47	276.83	84.40	106.52	93.65	+793	+1316	+1076	-220	*+115*	-114	***	***	***	000	*	0
V8	1487	2010	2113	374.16	356.65	347.15	105.39	113.92	117.43	+1089	+1447	+1504	*+76*	*+246*	+314	***	***	***		***	***
V9	1207	1620	1768	303.69	287.46	290.53	85.54	91.82	98.28	+809	+1057	+1160	-204	-144	-31	***	***	***	000	0	
V10	1177	1710	1850	296.31	303.43	303.89	83.46	96.92	102.80	+780	+1147	+1241	-233	-54	+50	***	***	***	000		
V11	400	870	993	100.59	154.29	163.14	28.33	49.28	55.19	+2	+306	+384	-1011	-895	-806		***	***	000	000	000
V12	851	1280	1244	214.09	227.14	204.38	60.30	72.55	69.14	+453	+717	+635	-560	-484	-555	***	***	***	000	000	000
2019							2020						2021								
LSD 5% = 92.52 kg/ha LSD 1% = 126.11 kg/ha LSD 0.1% = 169.49 kg/ha							LSD 5% =106.84 kg/ha LSD 1% = 145.62 kg/ha LSD 0.1% = 195.71 kg/ha						LSD 5% = 116.06 kg/ha LSD 1% = 158.11 kg/ha LSD 0.1% = 212.50 kg/ha								

*Co.1 - Control untreated; Co.2 - 2 mechanical hoeing.

In 2021, compared to Co.1, when applying herbicides and herbicide combinations all experimental variants had very significant production increases, statistically assured, and compared to Co.2 a very significant increase in production, statistically assured (314 kg/ha) was obtained when applying the combination with the herbicides Gardoprim Plus Gold 500 SC + Merlin Flex (V8), in post-emergency treatments with Leopard 50 EC + Merlin Flex (V3) obtained a distinctly significant increase in production (182 kg/ha). For Dual Gold 960 EC + Merlin Flex (1.2 + 0.3 l/ha) (V5) a significant increase in production (156 kg/ha) was obtained compared to Co.2 (Table 4).

CONCLUSIONS

The combined herbicides and the combination of herbicides, applied pre-emergently and post-emergence to the chickpea culture had a good control effect, highlighting their effectiveness through a single application, in some variants.

Gardoprim Plus Gold 500 SC 4.0 l/ha combined herbicides + Merlin Flex 0.3 l/ha applied in pre-emergence ensure crop protection against weeds, with maximum efficiency and very good persistence, by reactivating herbicides due to rainfall after sowing.

The effectiveness of the herbicide application depends on the level of infestation, dominance, weed spectrum, applied dose and climatic conditions, but in the impossibility of chemical weed control, by applying the two mechanical hoeing high yields are obtained.

Regarding the effectiveness of weed control in chickpeas, the V3 variant [Leopard 50EC (1.2 l/ha) + Merlin Flex (0.150 l/ha)] applied in early post-emergence together with the V8 variant [Gardoprim Plus Gold 500 SC (4.0 l/ha) + Merlin Flex (0.3 l/h) preem.], were appreciated as having a very good efficacy, being very close as a percentage of control registering an efficiency superior to 95-97%, both at monocotyledonous weeds and dicotyledonous weeds When applying the combination of Gardoprim Plus Gold 500 SC herbicide (4.0 l/ha) + Merlin Flex (0.3 l/ha), has been obtained significant production increases in each year of study.

Of all the tested variants, the variant with the application of Gardoprim Plus Gold 500 SC herbicides (4.0 l/ha) + Merlin Flex (0.3 l/ha) in pre-emergence stands out, both as a percentage of weed control and as a high level of production, which allows us to recommend it in weed control in chickpeas.

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