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STUDY REGARDING THE WEED CONTROL IN GRAIN SORGHUM CROP

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Abstract

Compared to corn, sorghum is more sensitive to the action of synthetic chemicals in the administered herbicides and most of the time the plant stagnates in growth for a few days, even if the application doses are moderate. As the spectrum of weeds is quite diverse in Romania, there are species that are difficult to control in sorghum culture, such as Sorghum halepense, Setaria ssp. or Echinochloa crus-gali L., in this research we tested several variants of weed control using herbicides applied in pre and post emergence. The most valuable variant in combating weeds in grain sorghum crop proved to be the variant with Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha applied in pre-emergence + Trek P 334 SE (Pendimetalin 64 g/l + Terbuthylazine 270 g/l) 2.5 l/ha applied post-emergence, variant which had a calculated Abott's coefficient of 98.2%. The combination of Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper 0.4 l/ha (5% prosulfuron+50% dicamba) also provided a high cultural hygiene assurance, and was close to the previous variant with a calculated coefficient of 97.5%.

Key words: *grain sorghum, herbicide efficacy, weed control, yields.*

INTRODUCTION

Grain sorghum is widely known as a crop with low demands for vegetation factors, the main limiting factor of the extension of the sorghum crop is the finding of an assortment of herbicides that will control the degree of weeds in the sorghum crops, especially in the first 40-45 days after emergence, when sorghum plants have a slow growth rate and can be easily invaded by weeds (Matei Gh., 2013; Matei et al., 2019; 2020; Corbett et al., 2004).

Unlike in other major crops, such as maize or soybean, herbicide-resistant sorghum technology that can facilitate weed control throughout crop growing season is not available to growers yet. The development of herbicide-resistant sorghum can have potential to improve weed management, including post-emergence grass weed control. One of the major concerns in the development of such technology in sorghum is escape of resistance traits into weedy relatives of sorghum (e.g. shattercane and johnsongrass - Pandian et al., 2021)

Thus, weed management in grain sorghum has been and continues to be a production challenge for growers. Weed species can be very competitive with sorghum and can significantly reduce grain yields (Thompson et al., 2019).

In a recent study related on the efficacy of some herbicides on grain sorghum (Tkalich et al., 2023) showed that the greatest chemical control of weeds in grain sorghum crop was provided by the application options of herbicides Varyag - 4.5 l/ha and Agent - 0.6 l/ha in the phase of 3-5 leaves of the crop in June. This treatment provides to the Ponki grain sorghum hybrid led to a yield increases of 24-27% compared to the control.

Having the same purpose as our research, a field trials were conducted for two seasons with the objective of testing the comparative efficacy of herbicides applied singly or in combination, and the integration of chemical and manual methods of controlling weeds in grain sorghum crops. All the treatments reduced the density and dry weights of dominant weeds, and increased the grain yields compared to weedy control plots. Treatments having metolachlor at 1.0-1.25 kg ha^{-1}, a combination of atrazine + metolachlor, sequential application of metolachlor and bentazon, atrazine at 0.75 and metolachlor at 1.0 kg ha^{-1} as pre-emergence followed by one manual weeding around 30 days after sowing were superior to the rest (Ramakrishna et al., 1991; Ramakrishna, 2003).

From the technological point of view, the most valuable approach to faith against the weeds it is an integrated fight, using all the elements that can significantly reduce the presence of weeds: agrotechnical measures, fertilization, the quality of soil work, the previous plant, respect for thickness, sowing in the optimal time etc. (Nicolescu et al., 2008). Another major problem is the crop adaptability to environmental conditions, especially temperature and humidity (Soare et al., 2019). Sorghum is grown in tropical, semi-tropical, arid and semi-arid areas, in over 120 countries across Africa, Asia, Australia and Europe (Balole and Legwaila, 2006; FAO 2023; Shewale and Pandit, 2011; Matei et al., 2022), between the North latitudes of 50° (North America and Russia) and South latitudes of 40° S in Argentina (Smith and Frederiksen, 2000).

MATERIALS AND METHODS

The research was carried out at Agricultural Research and Development Station Caracal (ARDS), during the 2020 year in the conditions of a chermozem soil, medium rich in nutrient and with a humus content which varied between 3% to 4%. The soil in the arable layer (0-20 cm) has a lutearic texture with a clay content (particles below 0.002 mm) of 36.2%, an apparent density of 1.42 g/cm^3, a total porosity of 47% and one medium penetration rate (penetration resistance of 42 kg/cm^2).

From the point of view of the hydric features of soil in the superficial layer, the wilting coefficient records the value of 12.3%, the field capacity 24.5% and the hydraulic conductivity is 9.2 mm/h.

The main aim of the study was research was to establish the most valuable herbicides for grain sorghum hybrids cultivated in the area of Caracal Plain, in the above soil conditions.

As experimented genotype we use a grain sorghum hybrid ES Alizee from Euralis Company, a semi early hybrid, with high tolerance on drought, high tolerance to shatter and shake.

In the experiment we use 30 seeds/square meter at sowing time and as a fertilization background for the sorghum crop tested, we applied a dose of $N_{150}P_{80}K_{80}$. The experience was placed in the field according to the randomized blocks method.

As variants we tested the herbicides with pre-emergent and post emergent applied time. The applied doses are presented in Table 1.

In all variants seeds were treated with the herbicide antidote (safener) Concep III (fluxofenin) to protect sorghum from the phytotoxic effect of antigramin herbicides.

Table 1. Variants of tested herbicides on grain sorghum in 2020 – ARDS Caracal

No.	Variants	Active substances	Doses (l/ha)	Application time
1	Untreated variant	-	Control	Control
2	Dual Gold + Casper	S-metolaclor 960 g/l + 5% prosulfuron+50% dicamba	1.5+0.4	pre+ post emergence
3	Trek P 334 SE	Pendimetalin 64 g/l + Terbutilazin 270 g/l	3.5	preemergence
4	Wing P	Pendimetalin 250 g/l + dimetenamid 212,5 g/l	3.5	preemergence
5	Gardoprim Plus Gold 500 SC	S-metolaclor 312,5 g/l + terbutilazin 187,5 g/l	3.5	preemergence
6	Dual Gold + Trek P 334 SE	S-metolaclor 960 g/l +Pendimetalin 64 g/l + Terbutilazin 270 g/l	1.5+2.5	pre+ post emergence
7	Dicopur TOP 464 SL	Acid 2,4 D 344 g/l	1	postemergence
8	Buctril universal	Bromoxilin 280 g/l + acid 2,4 D (ester) 280 g/l	1	postemergence

During the vegetation period of the sorghum were made biometric measurements in the field. Those were completed in the laboratory with the analyze of yields related the content of starch and protein using the NIR Tango Brucker analyzer.

All collected data were processed and interpreted using the method of analysis of variance (ANOVA).

Climatic conditions (Figure 1 and Table 2) during the experiment had an important influence on the evolution of grain sorghum crop. From the point of view of temperature, the recorded data certify that the agricultural year of 2020 was an excessively warm year, that continued the period with high thermal values from the previous years. Compared to the normal of the area, an average of temperature of 12.7ºC was achieved, 2.7ºC higher than the normal of the area, which represents 10.6ºC. About the thermal regime of the months of the warm period of the year (April - September), we note that in the interval of April-August, temperatures lower than the multi-year average were not recorded. The deviations were positive, between 0.2-3.5ºC. The precipitation that fell in this agricultural year, between October 2019 - September 2020, totaled 529.0 mm, being with 8.4 mm lower than the multiannual average, which is 537.4 mm. In these conditions where the level of precipitation was lower, the important element to be taken into account was represented by the non-uniformity of their distribution during the vegetation period of the sorghum crops.

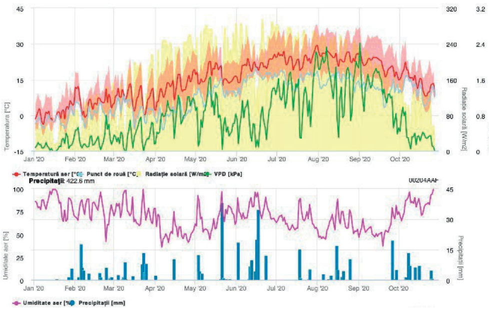

Figure 1. Climatic conditions of 2020 year – period of January - November – precipitations and ETO (mm)

In the warm period of the year, the months of April, July, August and September stand out as very poor in precipitation, when the precipitation registered deficit was between 5.9 mm and 30.8 mm. Also, in the warm period of the year, there was also a month, namely June, in which the precipitation exceeded the multiannual average by 41.0 mm, but the water that fell from the precipitation was ineffectively used by the plants due to the high temperatures, associated with the heat and a monthly evapotranspiration (ETO) calculated at 117.1 mm (Table 2).

The months of July, August and September, through the high level of ETO, decreased the production capacity of grain sorghum, with direct implications on the productivity elements: number of grains in the panicle, MMB etc.

In conclusion, during the grain sorghum vegetation period, months of May - September, the total of 262.4 mm numerically representing a small value, even for sorghum, which is a plant with relatively low requirements compared to the vegetation factor water, corroborated with the high temperature and the heat manifested on many days in July and August.

Table 2. Climatic conditions of 2020 year – period of January - September – temperature, precipitations and ETO (mm)

Year 2020	Air temperature [°C]			Solar radiation	Precipitations	Wind speed [m/s]		Daily ETO
Month	average	max	min	average [W/m2]	[mm]	average	max	(ET0) [mm]
January	0,82	14,17	-8,65	55,00	8,40	1,30	7,00	21,60
February	5,58	20,97	-6,20	89,00	47,40	2,20	11,40	42,50
March	7,46	23,84	-6,36	124,00	49,40	1,70	6,90	54,20
April	11,92	28,35	-3,58	210,00	12,80	1,50	7,30	102,10
May	16,81	31,71	5,02	215,00	61,60	1,70	7,50	121,20
June	20,77	35,73	4,86	217,00	108,00	1,00	4,50	117,10
July	23,74	37,98	11,26	233,00	22,60	0,80	5,10	138,00
August	24,72	36,97	12,32	220,00	44,80	0,80	5,70	129,40
September	21,17	37,10	6,63	173,00	25,40	1,00	6,70	95,40
Octomber	13,90	31,22	1,30	95,00	46,20	1,00	6,40	43,80
November	7,92	15,96	0,67	47,00	5,40	0,60	2,60	6,20
May - Sept	**20,18**				**262,4 mm**			**601,1**
Sum pp Jan - Nov					**432,0 mm**			**871,5 mm**

RESULTS AND DISCUSSIONS

In our experiment, during the 2020 year, 17 weed species were identified in grain sorghum crop for which herbicides were tested.

The analysis of the weed spectrum in the control variant (untreated) led to the identification of 4 species belonging to the *Monocotyledonous class* that appeared with high frequency: *Setaria* sp.*, Echinochloa crus-gali* L.*, Digitaria sanguinalis* and *Sorghum halepense* (from seeds and rhizomes).

Among the species belonging to the *Dicotyledonous class*, with high frequency were recorded: *Xantium* sp., *Portulaca oleracea, Chenopodium album, Amaranthus retroflexus* and with a lower frequency *Solanum nigrum* and *Cirsium arvense.*

In 2020, the most valuable in combating weeds in grain sorghum culture for the Caracal Plain area proved to be the variant with Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha applied in pre-emergence + Trek P 334 SE (Pendimetalin 64 g/l + Terbuthylazine 270 g/l) 2.5 l/ha applied post-emergence, variant that had a calculated Abott's coefficient of 98.2% (Table 3).

The combination of Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper (5%

prosulfuron+50% dicamba) 0.4 l/ha also provided a high degree of cultural hygiene assurance, and was close to this variant. l/ha, sour variant had a calculated coefficient of 97.5%.

The variants with herbicides with Trek P 334 SE (Pendimetalin 64 g/l + Terbuthylazine 270 g/l) 3.5 l/ha and Gardoprim Plus Gold 500 SC (S-metolachlor 312.5 g/l + terbuthylazine 187.5 g/l) 3.5 l/ha were also noted as valuable with high efficiency against the weeds, reached 97.2% and respectively 94.1% Abbot's coefficient.

Table 3. Herbicides efficacy on grain sorghum in 2020

Variant	Dose l/ha	Active substance	Application time	Efficacy*	EWRS **
Untreated variant	-	-	-	Control	-
Dual Gold + Casper	1.5 + 0.4	S-metolaclor 960 g/l + 5% prosulfuron+50% dicamba	Pre +Post Emergence	97.5	1
Trek P 334 SE	3.5	Pendimetalin 64 g/l + Terbutilazin 270 g/l	Pre Emergence	97.2	1
Wing P	3.5	Pendimetalin 250 g/l + dimetenamid 212,5 g/l	Post Emergence	91.3	1
Gardoprim Plus Gold 500 SC	3.5	S-metolaclor 312,5 g/l + terbutilazin 187,5 g/l	Post Emergence	94.1	1
Dual Gold + Trek P334 SE	1.5 + 2.5	S-metolaclor 960 g/l +Pendimetalin 64 g/l + Terbutilazin 270 g/l	Pre +Post Emergence	98.2	1
Dicopur TOP 464 SL	1	Acid 2,4 D 344 g/l	Post Emergence	85.1	1
Buctril universal	1	Bromoxilin 280 g/l + acid 2,4 D (ester) 280 g/l	Post Emergence	84.2	1

*The herbicide efficacy (at 30 days from treatment) was estimated using the Abott's formula:

$$\text{Corrected } \% = \left(1 - \frac{\text{n in T after treatment}}{\text{n in Co after treatment}}\right) * 100$$

**The herbicide selectivity for Jerusalem artichoke plants was appreciated using EWRS scale: 1 = unaffected; 9 = affected in percent of 85-100%;

The combination of Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper (5% prosulfuron+50% dicamba) 0.4 l/ha also provided a high degree of cultural hygiene assurance, and was close to this variant. l/ha, sour variant had a calculated coefficient of 97.5%.

The variants with herbicides with Trek P 334 SE (Pendimetalin 64 g/l + Terbuthylazine 270 g/l) 3.5 l/ha and Gardoprim Plus Gold 500 SC (S-metolachlor 312.5 g/l + terbuthylazine 187.5 g/l) 3.5 l/ha were also noted as valuable with high efficiency against the weeds, reached 97.2% and respectively 94.1% Abbot's coefficient.

Similar results were obtained by Thomson et al., 2019, which mentioned an efficacy of applied herbicides on grain sorghum of 90% or better in weed control.

Weed infestation is one of the major threats to cereal production in all the area where they are cultivated. Lots of studies were focused on the evaluations of different types of herbicides for weed control in sorghum crops. Among the herbicides tested, as a.i., pretilachlor + dimethametryne at 2.5 kg a.i./ha, cinosulfaron at 0.05 kg a.i./ha and piperophos + cinosulfuron at 1.5 kg a.i./ha performed best as they effectively controlled weeds, increased crop vigor, plant height, reduced crop injury and produced higher grain (Ishaya et al., 2007).

Due the very reduces number of herbicides for sorghum different agricultural practices were tested in order to have a better efficacity against weeds. Ramakrishna A., 2003, placed this practice into an integrated system to combated the weeds using smother cropping with cowpea or mungbean and using metolachlor or pendimethalin pre-emergent at 1.0 kg active ingredient (ai) ha (-1). All the weed management treatments were remunerative over the untreated control and resulted in substantial economic gains. However, substantial additional profit over the clean-weeded check was obtained only with metolachlor pre-emergent at a rate of 1.5 kg ai ha (-1).

Related the plant's heights it can be observed in Figure 2 that the efficacy of applied herbicides had directly influenced the evolution of grain sorghum morphological characters, especially the height.

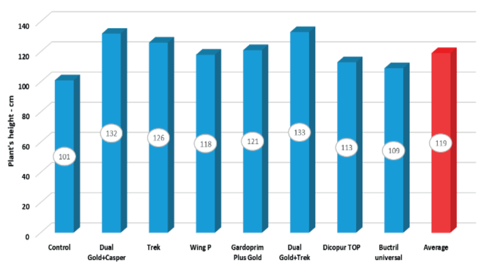

Figure 2. The influence of the applied herbicides to the plant's height

The tallest plants were recorded in the variant with Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha applied in pre-emergence + Trek P 334 SE (Pendimetalin 64 g/l + Terbuthylazine 270 g/l)

2.5 l/ha applied post-emergence with a value of 133 cm, followed by the variant with Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper (5% prosulfuron+50% dicamba) 0.4 l/ha, with a closer value of 132 cm.

From this point of view, it is highlighted the variant where we use Trek P 334 SE (Pendimetalin 64 g/l + Terbuthylazine 270 g/l) 3.5 l/ha in preemergence which ensure a proper cultural hygiene and very good conditions for plant's development.

Weed control effectiveness was directly observed in the level of productions obtained compared to the untreated variant used as control (Table 4). Thus, this year in the experience with herbicides (for the Alizee grain sorghum hybrid) it was between 2,023 kg/ha in the untreated variant and 6,866 kg/ha when the combination of Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha applied pre-emergence + Trek P 334 SE (Pendimethalin 64 g/l + Terbuthylazine 270 g/l) 2.5 l/ha post-emergence was applied.

Table 4. Herbicides influence on grain sorghum yields in comparison with untreated variant (Control 1)

Variant	Dose l/ha	Yield kg/ha	Yield %	Differences kg/ha	Signif.
Untreated variant	**Control**	**2,023**	**100**	**Control**	**Control**
Dual Gold + Casper	1.5+ 0.4	6,797	336	4774	***
Trek P 334 SE	3.5	6,531	323	4508	***
Wing P	3.5	4,611	228	2588	**
Gardoprim Plus Gold 500 SC	3.5	5,323	263	3300	***
Dual Gold + Trek P 334 SE	1.5+ 2.5	6,866	339	4843	***
Dicopur TOP 464 SL	1	4,140	205	2117	**
Buctril universal	1	4,106	203	2083	**

LSD 5% = 1,152 kg/ha; LSD 1% = 1,638 kg/ha; LSD 0.1% = 2,879 kg/ha

It is quite easy to observe, due the results, that the most valuable scheme against weeds proved to be the associate applied herbicides, including the variant of Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper (5% prosulfuron+50% dicamba) 0.4 l/ha.

Among the variants in which we applied a single product, we note Trek P 334 SE (Pendimetalin 64 g/l + Terbuthylazine 270 g/l) herbicide applied whit a dose of 3.5 l/ha in preemergence, variant with a yield of 6,531 kg/ha. This product was also noted along the research carried out during 3 years made by other researchers (Isticioaia et al., 2017) and recommend to be included in the portfolio of herbicides associated with sorghum cultivation technology.

The yields recorded in this year showed another variant of herbicide which can also be borrowed from maize portfolio - Gardoprim Plus Gold 500 SC (S-metolachlor 312.5 g/l + terbuthylazine 187.5 g/l) 3.5 l/ha - whose harvest reached the value of 5,323 kg/ha.

The increases recorded in all variants with herbicides, regardless of the active substance contained, achieved productions statistically assured as very significant compared to the untreated control. Synthesizing the previously exposed data, the best results were obtained (for the Alizee hybrid treated with Concep III) when we applied a pre-emergent herbicide scheme with Dual Gold 960 EC (S-metolachlor 960 g/l) in a dose of 1.5 l /ha or Gardoprim Plus Gold 500 SC (S-metolachlor 312.5 g/l + terbuthylazine 197.5 g/l), in a dose of 3.5 l/ha and the post-emergence herbicide with the product Casper (5% Prosulfuron+50% Dicamba), applied in a dose of 0.4 l/ha.

If we look at the yields in comparison with the average/experience – taken as Control 2 – who's value was 5,050 kg/ha, it is obvious that only the previous highlighted variants were able to registered positive increases in productions which were ensured from statistically point of view as distinct significant (Table 5). In this case variant with Gardoprim Plus Gold 500 SC (S-metolachlor 312.5 g/l + terbuthylazine 187.5 g/l) 3.5 l/ha recorded a plus production of 273 kg/ha, but this increase was not enough to be statistically ensured.

Table 5. Herbicides influence on grain sorghum yields in comparison with average/experiment (Control 2)

Variant	Dose l/ha	Yield kg/ha	Yield %	Differences kg/ha	Signif.
Untreated variant	-	2,023	40	-3,027	ooo
Dual Gold + Casper	1.5+ 0.4	6,797	135	1,747	**
Trek P 334 SE	3.5	6,531	129	1,481	**
Wing P	3.5	4,611	91	-439	-
Gardoprim Plus Gold 500 SC	3.5	5,323	105	273	-
Dual Gold + Trek P 334 SE	1.5+ 2.5	6,866	136	1,816	**
Dicopur TOP 464 SL	1	4,140	82	-910	-
Buctril universal	1	4,106	81	-944	-
Average	**Control**	**5,050**	**100**	**Control**	**Control**

LSD 5% = 980 kg/ha; LSD 1% = 1,432 kg/ha; LSD 0.1% = 2,724 kg/ha

The productivity of crops is influenced by a series of natural factors, such as climate and soil, the pressure exerted by diseases, pests and weeds on the capacity to generate large productions, but also by the quality of these yields (Dima et al., 2023; Sălceanu et al., 2023; Sărățeanu et al., 2023). Also, there will be crop relocation, diseases associated with changes in the atmospheric composition and global climate with economic consequences from crop loss and changes in host-pathogen relationship (Paraschivu et al., 2022; Paraschivu et al., 2023).

In our case, the effect of weeds from the grain sorghum crop has been quantified even from the point of quality of productions. In Figure 3 we present the main influence of herbicide efficacy to the main elements of productivity: seeds humidity at harvest time (U%), hectolitric weight (MH - kg/hl) and weight of a thousand seeds (WTS - grams), which had a large variability due the treatment applied to the variants.

The seeds humidity at harvest time ranged between 13.1% at Control and variant with Buctril universal (Bromoxilin 280 g/l + acid 2,4 D (ester) 280 g/l) applied in postemergence in dose of 1 l/ha and 13.8% registered at variant Wing P (Pendimetalin 250 g/l + dimetenamid 212.5 g/l) also in post-emergence of grain sorghum plants.

The most valuable variants as high yields, Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha applied pre-emergence + Trek P 334 SE (Pendimethalin 64 g/l + Terbuthylazine 270 g/l) 2.5 l/ha post-emergence and Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper (5% prosulfuron+50% dicamba) 0.4 l/ha had recorded values of 13.5% and respectively 13.2%.

The hectoliter weight (kg/hl) was situated around 80 kg/hl with the exception of the Control – the untreated variant – which had a lower value, of 66 kg/hl. The highest value was observed at variant with Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper (5% prosulfuron+50% dicamba) 0.4 l/ha.

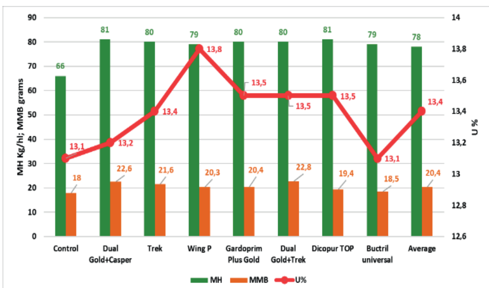

Figure 3. The influence of the applied herbicides to the main production’s elements

The weight of a thousand seeds (WTS - grams) has been also influenced by the presence of the weeds in the grain sorghum crop and ranged between 18 grams at Control and 22.8 grams recorded on the best variant with Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha applied pre-emergence + Trek P 334 SE (Pendimethalin 64 g/l + Terbuthylazine 270 g/l) 2.5 l/ha post-emergence.

Closer value, of 22.6 grams, was registered at variant Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper (5% prosulfuron+50% dicamba) 0.4 l/ha in post-emergence.

Weed competition on sorghum plants was also quantified in the **level of protein and starch** in sorghum grains (Figure 4).

The highest level of protein accumulations has been recorded at variant with Trek P 334 SE (Pendimethalin 64 g/l + Terbuthylazine 270 g/l) 3.5 l/ha pre-emergence, of 13.7%, followed by variant with Gardoprim Plus Gold 500 SC (S-metolachlor 312.5 g/l + terbuthylazine 187.5 g/l) 3.5 l/ha also in pre-emergence, of 13.2% and 12.8% at variant with Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha applied pre-emergence + Trek P 334 SE (Pendimethalin 64 g/l + Terbuthylazine 270 g/l) 2.5 l/ha post-emergence.

The quality of the grain sorghum is influenced mainly by two groups of factors: genetically and technologically ones.

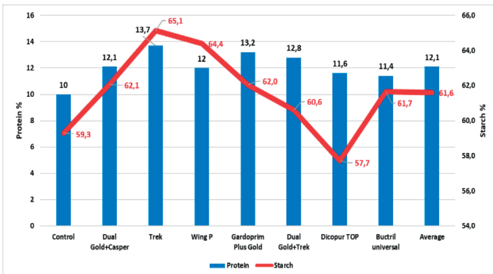

Figure 4. The influence of the applied herbicides to the quality production’s

Grain sorghum starch is one of the most valuable components appreciated in bakery - composite flour used in the formula for baking gluten and gluten-free products, fresh juice, extracted of strains used in the manufacture of syrup, vinegar and other food industry or for the production of raw materials, for energy (liquid, solid, gas, electricity, heat) and chemical industry (Coclea et al., 2014).

It was observed a similarity of starch accumulation with the protein ones. The highest level of starch had registered at variant with Trek P 334 SE (Pendimethalin 64 g/l + Terbuthylazine 270 g/l) 3.5 l/ha pre-emergence, of 65.1%. Beside this value were situated those from variant with Wing P (Pendimetalin 250 g/l + dimetenamid 212.5 g/l) applied in dose of 3.5 l/ha in post-emergence, of 64.4% and Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper (5% prosulfuron+50% dicamba) 0.4 l/ha, of 62.1%.

CONCLUSIONS

This research has identified a series of herbicides, with application both in pre-emergence and post-emergence stages, which can ensure a very good protection for sorghum plants and a very high weed control rate in the crop, of over 90% for the majority of them.

Another important element is the fact that in relation to the impact of the active chemical molecules of these herbicides to crop they provide to have a very high selectivity for grain sorghum plants, the ratings according to the EWRS scale being 1 for all the tested variants.

From the point of view of productions, the variants which ensured highest levels of yields we noticed those schemes with two moments of application: Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha applied pre-emergence + Trek P 334 SE (Pendimethalin 64 g/l + Terbuthylazine 270 g/l) 2.5 l/ha in post-emergence and Dual Gold (S-metolachlor 960 g/l) 1.5 l/ha + Casper (5% prosulfuron+50% dicamba) 0.4 l/ha in postemergence.

From the single products variants, the most valuable proved to be those applied in pre-emergence as Trek P 334 SE (Pendimethalin 64 g/l + Terbuthylazine 270 g/l) 3.5 l/ha and Gardoprim Plus Gold 500 SC (S-metolachlor 312.5 g/l + terbuthylazine 187.5 g/l) 3.5 l/ha.

Related the quality of productions we can add the variant of Trek P 334 SE (Pendimethalin 64 g/l + Terbuthylazine 270 g/l) 3.5 l/ha pre-emergence and Wing P (Pendimetalin 250 g/l + dimetenamid 212,5 g/l) applied in dose of 3.5 l/ha in post-emergence.

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