Original scientific paper
Originalan naučni rad
UDK: 634.75-154.6(85)
DOI: 10.7251/AGREN1204547P

University of Banjaluka, Faculty of Agriculture
Agro-knowledge Journal

Investigation of the Efficiency and Selectivity of Some Herbicides Applied on Cape Gooseberry (*Physalis peruviana* L.)

N. Panayotov[1], M. Dimitrova[1], L. Krasteva[2], D. Dimova[1], D. Svetleva[1]

[1]*Agricultural University, Plovdiv, Bulgaria*
[2]*"K. Malkov" IPGR, Sadovo, Bulgaria*

Abstract

The main goal of the present paper was to study the possibilities for application of herbicides during vegetation of cape gooseberry. Herbicides Afalon 100 and 150 ml/da and Agil 85 and 150 ml/da were applied at the moment of the beginning of bud formation on the Plovdiv variety. The control was not treated, but it was hoed. Twenty days later, species, number and weight of weeds; number of dead cape gooseberry plants; weight, diameter and length of fruits (in botanical maturity) were investigated. Productivity and chemical components were determined. The highest effectiveness, lowest weed number and weight were observed when using Afalon 150 ml/da which controls annual dicotyledon weeds. Total weeds weight decreased mainly due to Afalon. The highest percentage of dead plants was established after application of 150 ml/da Afalon. The highest productivity was established in control. Investigated herbicides, Afalon and Agil, did not demonstrate satisfactory selectivity in cape gooseberry.

Key words: cape gooseberry, herbicides, fruit, selectivity, yield.

Introduction

Cape gooseberry is a new vegetable crop in Bulgarian agriculture. It has tasty fruits, very good storability and attractive shape. These traits make the crop suitable for growing, especially on small-scale farms and in order to enrich diversity of fresh vegetable production on the market. In many countries, investigations concerning growing cape gooseberry in different climatic conditions have recently been held such as Argentina (Cerri, 2006), Hungary (Paksi et al., 2007), New Zealand and India (McCain, 1993), etc.

Further studies about technological practices are concerned with problems of fertilisation, growing of transplants and sowing time. Crawford (2004) pointed out that cape gooseberry is very adaptive to different soil types, although it prefers well sunlit places. The same conclusion, namely that this crop is not very demanding in terms of soil conditions, was also reported by Chernok (1997). Crawford (2004) established that the cape gooseberry seeds germinate fast and this is a good prerequisite for seed propagation. Nevertheless, R. McCain (1993) recommends that for it is better to propagate it from seedlings to achieve successful growth. In South Australian conditions, Kendall (2008) emphasised that the quantities of nitrogen fertilisation have to be very preise in cape gooseberry.

The studies about weed control in *Physalis peruviana* L. are very limited and insufficient. Plaza, G. A. and y M. Pedraza (2007) carried out experiments with the aim to establish various herbaceous plants associated with cape gooseberry (*Physalis peruviana* L.) in Colombia. They observed that the most frequently found species are *Polygonum nepalense, Rumex crispus*, *Pennisetum clandestinum* and *P. nepalense*. Auld, B.A. and Medd R.W. (1992) examined some herbicides in the field with cape gooseberry as Glyphosate, Lontrel and Tordon 75-D in conditions of South Australia and found that Glyphosate in 1 l/100 l water was the most effective against weeds. Hussey, B.M.J et al (1997) also found that Glyphosate yielded very good results in weed control. Hernándo-Bermejo and León (1994) reported that some species of gender *Physalis* showed resistance to 2,4-D amine herbicide. To reduce weeds in cape gooseberry, McCain (1993) recommended drop by drop irrigation.

The main goal of this paper was to investigate the possibilities for application of herbicides during vegetation of cape gooseberry.

Materials and methods

The experiments were carried out in the Experimental fields of the Department of Horticulture at the Agricultural University, Plovdiv, Bulgaria during 2009-2011 with the first Bulgarian variety of cape gooseberry Plovdiv. The plants were grown by transplants sown in the middle of March in an unheated plastic house and transplanted in the middle of May by scheme 70×50 cm. The experiments were conducted in four replications using 8 m^2 plots. Conventional technology was applied for the field production during the middle period of growing season in the south Bulgarian conditions.

At the beginning of flower bud formation, the following herbicides were applied: Afalon 45 CK (linuron 450 g/l) in the concentration of 100 ml/da and 150 ml/da and Agil 100 EK (propaquizafop 100 g/l) in the concentration of 85 ml/da and 150 ml/da by using intended 60 l/da water solution. The control variant was not treated, but it was hoed two times. Twenty days after herbicide application, the number and weight of the different weed species per sq. m. as well as perished cape gooseberry plants were established. The weight, length and diameter of fruits were measured in the full botanical maturity. The dry weight, total sugar, total acid and vitamin C were

analysed by using the methods described by Stambolova et al. (1978). The productivity was also determined. Statistical analyses were done according to ANOVA.

Results and discussion

In the experimental areas with cape gooseberry, the following weeds were mainly observed: Purslane - *Portulaca oleraceae* L., Johnson Grass - *Sorghum helepense* L., Chingma Abutilon - *Abutilon theofrasti* Med., Beet root - *Amaranthus retroflexus* L., Bindweed – *Convolvulus arvensis* L., Creeping Thistle - *Cirsium arvense* Scop., Fat Hen - *Chenopodium album* L. and Black Nightshade - *Solanum nigrum* L.

The results concerning the effectiveness of herbicides are shown in Table 1. The application of Agil herbicide in cape gooseberry did not cause sufficient reduction of weeds. The lowest total number of weeds was counted in Afalon 150 ml/da. In this variant annual dicotyledon weeds amounted to 3.5 per sq. meter. This herbicide had high impact on *Portulaca oleraceae* L., *Chenopodium album* L., *Amaranthus retroflexus* L. and *Solanum nigrum* L. In a 100 ml/da dose, the number of the above mentioned weeds was significantly higher and reached 6.5 nr./m^2. Agil controlled only annual and perennial monocotyledon weeds. Therefore, the density of weeds in the experimental plots was 91.6 (Agil 80 ml/da) whereas in higher doses, they amounted to 78.6. Statistical significance was established.

Tab. 1. Number of weeds per sq. m., average 2009-11
Broj korova po m^2, prosjek 2009-2011. god.

Variants	Total	Annual weeds *Jednogodišnji korovi*					Perennial weeds *Višegodišnji korovi*		
		Portulaca oleraceae L.	*Chenopodium album* L.	*Abutilon theofrasti* Med.	*Amaranthus retroflexus* L.	*Solanum nigrum* L.	*Sorghum helepen-se* L.	*Convolvulus arvensis* L.	*Cirsium arvense* Scop.
Control	61.5	8.1	4.0	6.2	1.8	6.3	10.2	3.3	10.6
Afalon 100 ml/da	46.0	0.9	0.4	3.8	0.8	0.6	17.0	9.2	13.3
Afalon 150 ml/da	42.4	0.0	0.0	3.3	0.1	0.1	17.3	8.6	13.0
Agil 80 ml/da	91.6	33.0	5.2	10.2	4.8	10.8	4.6	10.5	12.5
Agil 150 ml/da	78.6	25.1	5.0	10.8	4.7	11.2	0.0	9.4	12.4
LSD $p_{0.05}$	18.3	8.2	4.5	4.8	2.9	3.9	6.8	3.6	4.2

The weight of the weed (Table 2) treated with Afalon was lower than in the control. The results indicate that in both doses of this herbicide the decrease was 15-17%. Higher density of weeds in variants with Agil also determined higher total weight. In a dose of 80 ml/da, the values of this parameter were two times higher in comparison with the control. In the next dose of this herbicide, the change in weed weight in comparison to non-treated plants was by 42% from the above.

Tab. 2. Weight of weeds in growing of Cape gooseberry, average 2009-11 (g/m^2)
Težina korova prilikom uzgoja peruanske jagode, prosjek 2009-11. god. (g/m^2)

Variants	Total	Annual weeds *Jednogodišnji korovi*					Perennial weeds *Višegodišnji korovi*		
		Portulaca oleraceae L.	*Chenopodium album* L.	*Abutilon theofrasti* Med.	*Amaranthus retroflexus* L.	*Solanum nigrum* L.	*Sorghum helepensisi* L.	*Clematis recta* L.	*Cirsium arvense* Scop.
Control	775.1	186.2	88.3	53.7	4.3	81.3	320.1	3.8	37.4
Afalon 100 ml/da	648.8	32.1	15.4	27.3	1.9	7.9	501.2	40.5	22.5
Afalon 150 ml/da	657.7	0.0	0.0	23.5	0.2	1.3	579.6	31,4	21,7
Agil 80 ml/da	1570.6	1030,7	156.8	50,5	12.3	117.7	148,2	27.2	27.2
Agil 150 ml/da	1101.0	586,2	256.8	89.4	12.2	123.2	0,0	17.1	16.1
LSD $p_{0.05}$	156.8	48.3	25.8	12.5	6.4	35.7	19.8	10.2	16.4

The applied herbicides did not demonstrate good selectivity (Table 3). The biggest percentage of dead cape gooseberry plants was recorded using higher concentration of Afalon and Agil, 23.85% and 18.85%, respectively. Lower doses cause perishing of 13.33% and 11.42%, respectively. Decrease in fruit weight was observed after using of the herbicides. This was especially found in the variants with higher quantity of herbicides - with 32.2% and 26.3% for 150 ml/da Afalon and Agil, respectively. The diameter and length of fruits also decreased, but to a lesser degree. The influence of herbicides was stronger regarding the second parameter in the variant Agil 150 ml/l, where length was smaller by 34.6%.

The most important assessment of the effect of each agricultural practice is its influence on productivity (Table 4). After application of the herbicides, the yield of cape gooseberry was lower in comparison to control. The highest decrease was obtained in Afalon 150 ml/da, by 47.6%, followed by the lower concentration, by 39.8%. The yield was least decreased in 80 ml/l da Agil, but there was also significant reduction towards the non treated plants. On the one hand, this is related to the reduced number of plants as a result of their perishing due to the herbicides effect. On the other hand, decreased fruit weight also affects productivity. The highest density of weeds in

variants with Agil is also one of the main reasons of reduced yield. The content of chemical components in cape gooseberry fruit was slightly affected under the influence of herbicides.

Tab. 3. Perished plants and morphological fruits characteristics of cape gooseberry, 2009-11
Uginule biljke i morfološke karakteristike ploda peruanske jagode, 2009-11. god.

Variants	Perished plants (%)	Weight (g)	Diameter (cm)	Length (cm)
Control	0	5.62	1.98	3.5
Afalon 100 ml/da	13.33	5.02	1.93	2.8
Afalon 150 ml/da	23.85	4.25	1.98	3.0
Agil 80 ml/da	11.42	4.84	1.91	3.1
Agil 150 ml/da	18.85	4.45	1.92	2.6
LSD $p_{0.05}$	6.4	0.55	0.25	0.64

Tab. 4. Productivity and content of chemical components of cape gooseberry, average 2009-11
Produktivnost i sadržaj hemijskih komponenti peruanske jagode, prosjek 2009-11. god.

Variants	Productivity kg/da	Dry matter (%)	Total sugar (%)	Total acid (%)	Vitamin C mg%
Control	258,5	13.7	3.9	1.12	30.2
Afalon 100 ml/da	184,9	15.7	4.5	1.28	32.8
Afalon 150 ml/da	175.1	13.3	3.8	1.62	34.5
Agil 80 ml/da	208.1	14.2	4.1	1.35	29.8
Agil 150 ml/da	199.2	14.0	2.9	1.42	31.3
LSD $p_{0.05}$	28.7				

Conclusion

The total weight and density of weeds was lowest in application of both investigated doses of Afalon.

Afalon herbicide primarily influenced the plants from *Chenopodium album* L., *Portulaca oleraceae* L., *Amaranthus retroflexus* L. and *Solanum nigrum* L., while Agil mostly affected weeds of Sorghum *halepense* L.

The highest percentage of dead plants was established after application of 150 ml/da Afalon, followed by the same dose of Agil.

The productivity of plants treated with studied herbicides was lower in comparison to the control.

The investigated herbicides, Afalon and Agil, did not demonstrate good selectivity in cape gooseberry.

References

1. *Auld, B.A. and Medd R.W.* (1992). Weeds. An illustrated botanical guide to the weeds of Australia. Inkata Press, Melbourne, 227.
2. *Cerri, A. M.,* 2006. Performance of *Physalis ixocarpa* Brot. and *Physalis peruviana* L. at Buenos Aires. Revista de la Facultad de Agronomia (Universidad de Buenos Aires), 26 (3), 263-274.
3. *Chernok, L. G.,* 1997. Tomato, pepper, eggplant, cape gooseberry. Mn.: Ser. Vit., 228.
4. *Crawford M.* 2004. Yearbook. West Australian Nut and Tree Crops Associacian. Vol.27. p.42-51
5. *Hernándo Bermejo, J.E. and J. León,* 1994. Neglected Crops: 1492 from a Different Perspective. Plant Production and Protection Series No. 26. FAO, Rome, Italy. p. 117-122.
6. *Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G.* (1997). Western Weeds. A guide to the weeds of Western Australia. (Plant Protection Society of Western Australia, Perth, Western Australia).
7. *Kendall, H.,* 2008. Cape gooseberry. In: Kendall farm. http://www.kendallfarms.com.au/home2.htm (accessed October, 2008)
8. *McCain, R.* 1993. "Goldenberry, passion fruit, & white sapote: Potential fruits for cool subtropical areas." In New Crops, edited by J. Janick and J.E. Simon, pp. 479–486. John Wiley and Sons, New York.
9. *Paksi, A. M., Kassai, T., Lugasi, A., Ombodi, A., Dimeny, J.,* 2007. Physalis peruviana L. An alternative crop for small scale farms. Cereal Research Communications, 35 (2), 877-880.
10. *Plaza, G. A. and y M. Pedraza,* 2007. Recognition and ecological characterization of weeds associated with culture of cape gooseberry. Agronomia Colombiana vol.25 no.2.
11. *Stambolova M., T. Chopaneva, T. Argirova,* 1978. The guidance for practical work by biochemistry. Zemizdat, Sofia, 213.

Ispitivanje efikasnosti i selektivnosti nekih herbicida primjenjenih na peruanskoj jagodi (*Physalis peruviana* L.)

N. Panayotov[1], M. Dimitrova[1], L. Krasteva[2], D. Dimova[1], D. Svetleva[1]

[1]*Poljoprivredni univerzitet, Plovdiv, Bugarska*
[2] *IPGR "K. Malkov", Sadovo, Bugarska*

Sažetak

Glavni cilj ovog rada je bio da se ispitaju mogućnosti primjene herbicida tokom vegetacije peruanske jagode. Herbicidi Afalon 100 i 150 ml/da kao i Agil 85 i 150 ml/da su primjenjeni na sorti Plovdiv u trenutku početka formiranja pupoljaka. Kontrolni uzorak nije tretiran, nego je okopavan. Dvadeset dana kasnije, ispitivane su vrste, broj i težina korova; broj uginulih biljaka peruanske jagode; težina, prečnik i dužina plodova pri botaničkoj zrelosti. Utvrđena je produktivnost i hemijske komponente. Najveća efikasnost, najniži broj korova i težina ustanovljeni su pri korištenju Afalona 150 ml/da koji kontroliše jednogodišnje dikotiledonske korove. Ukupna težina korova je opala uglavnom zahvaljujući Afalonu. Najveći procenat uginulih biljaka je ustanovljen nakon primjene Afalona 150 ml/da. Najveća produktivnost je ustanovljena kod kontrolnog uzorka. Ispitivani herbicidi Afalon i Agil nisu pokazali zadovoljavajuću selektivnost kod peruanske jagode.

Ključne riječi: peruanska jagoda, herbicidi, plod, selektivnost, prinos.

N. Panayotov
E-mail Address:
nikpan@au-plovdiv.bg