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Research Article

Kışlık ve Yazlık Ekilen Bazı Nohut Çeşitlerine Kimyasal Uygulamaların Etkisi

Dürdane MART

Eastern Mediterranean Agricultural Research Institute -Turkey

Corresponding author: durdanemart@yahoo.com

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Öz

Bu araştırma Doğu Akdeniz Tarımsal Araştırma Enstitüsünde 2012 ve 2013 yıllarında yürütülmüştür. Dört nohut çeşidinde (İnci, Hasanbey, Seçkin, Aydın) kimyasal uygulamaların (Thidiazuron, thephon+Cyclanilide+Thidiazuron, Glyphosate, Ethephon+Cyclanilide) ve farklı ekim zamanlarının (kış ve erken ilkbahar) agronomik özellikler verim ve çimlenme üzerine etkileri araştırılmıştır. Kışlık ekimde bitki başına en fazla bakla ve tohum sayısı (sırasıyla 79,78-83,52) Aydın çeşidinin Ethephon+cyclanilide uygulamasında olurken, bitki başına en düşük bakla ve tohum sayısı (47,12 -52,5 ve 47,28-49,5 sırasıyla) Seçkin ve Hasanbey çeşitlerinin kontrol gruplarında bulunmuştur. Dolu bakla sayısı kontrol grubunda (Hasanbey) 41,96 ile Ethephon+siklanilid (Aydın) uygulamasında 68,99 arasında değişmiştir.

Anahtar kelimeler: Nohut,Farklı ekim zamanı, Bitki düzenleyicileri, Agronomik özellikler

The Effects of Chemical Treatments on Chickpea Varieties Sown Winter and Early Spring

Abstract

This research was carried out in Eastern Mediterranean Agricultural Research Institute in 2012 and 2013. The effects of chemical treatments (Thidiazuron,thephon+Cyclanilide+Thidiazuron, Glyphosate, Ethephon+Cyclanilide) and of different sowing dates (winter and early spring) in four chickpea varieties (Inci, Hasanbey, Seckin, Aydın) on agronomic traits yield and germinating were investigated. In winter sown, the highest number of pods and seeds per plant (79,78-83,52 respectively) was in Ethephon+cyclanilide treatment of the Aydin variety, while the lowest number of pods and seeds per plant (47,12 -52,5 and 47,28-49,5 respectively) was in control groups of the Seckin and Hasanbey varieties. Number of full pods per plant ranged from 41,96 in control group (Hasanbey) to 68,99 in Ethephon+cyclanilide (Aydin) treatment.

Key words: Chickpeas, sowing dates, plant regulators, Agronomic characteristics

Introduction

Chickpea (*Cicer arietinum* L.) is a crop in the Leguminosae family from genus Cicer with number of chromosome 2n=16, highly self-fertile. It is an important food source and contains high amounts of protein (average 23%), fiber and carbohydrates. Chickpea is contain highly digestible and close to animal-derived proteins in terms of amino acids (Thudi et al., 2011). Edible legumes are an important food source for human nutrition with their cheap and high-quality vegetable protein content, mineral, vitamin and fiber ratio (Sehirali, 1988; Friedman, 1996). In addition, it has symbiotic relationship with the rhizobium bacteria in its roots, which fix nitrogen to the soil. Therefore, its place in crop rotation is very valuable (Yorgancılar et al., 2008; Muehlbauer et al., 1987).

Chickpea, which is produced in almost every region of our country, ranks first among edible legumes with 55.4%. Over the years, chickpea cultivation areas and production have decreased due to contiune changing market, price and production inputs (Anonymous, 2010, Ustun

and Gulumser, 2003). Moreover, drought and high temperatures stresses caused by global warming have caused reductions in chickpea cultivation areas and production. In order to find solutions such problems, the new varieties are developed using various plant breeding methods (Kusmenoglu 1990; Cagırgan and Toker, 2001). Aim of plant breeding is to adapt plants to changing climatic conditions and to increase the yield under stress conditions (Mart, 2014; Trethowan et al., 2010). Breeding is required and continuous practices due to adaptation to a changing climate for yield, various stress-adaptive mechanisms, stress uncertainty, and broad genotype x environment interaction (Dwivedi et al., 2013). Crop cultivation practices such as sowing date and plant density, fertilization and weed control are important efforts that increased productivity together with plant breeding. The optimum sowing date plays an important role in getting potential yields. It was important to explore factors affecting the growth, development, yield and seed quality in crop production. For instance, early or delayed sowing drastically may reduce the yield of the crops, also cultivars which have different genetic base may differ in productivity. The effect of the growth environment on the optimum growth of a variety is quite high.

Different or same varieties may perform variously under changing environments. In our country, although chickpea cultivation in winter given high yield, anthracnose disease limits it. Early spring sowing is a must to avoid anthracnose blight disease. Since in these regions, spring rains show an insufficient and uneven distribution, so chickpea yield is low due to adversely affected by high temperature and drought stresses in this season (Slim et al. 1993). Pre-harvest rain, especially in chickpea, encourages vegatatif growth and has a negative effect on quality and germination percentage at harvest. Plant dryers and defoliants are widely used in seed production worldwide. In our country, defoliants are used in many plants, especially cotton, to take the harvest time forward and to protect them from the negative effects of precipitation. In this study, it will be tried to determine suit plant dryer and defoliant sets for chickpea, to determine the usage conditions and doses of these preparations for different sowing dates.

Material and Method

The experiment was carried out in the Eastern Mediterranean Agricultural Research Institute at Doğankent location in 2012 and 2013 years.

The maximum and minimum temperatures and rainfall for the months for experiment area were given in Table 1. The temperatures ranged from 9,5 °C on January to 28.2 °C on July in 2012-2013 growing season. The temperatures ranged from 10,4 °C on December to 28.23 °C on July in 2013-2014 growing season. The amount of rainfall ranged from 154,4 mm in December to 0,3 mm in July 2012-2013 growing season. Since the rainfall in March and April was less than long years, a dry period was experienced. 2012-2013 was wetter and cooler than those of 2013-2014 growing season. The maximum and minimum temperatures and rainfall for the months for experiment area were given in Table 2. The soil at experimental site was a sandy texture, pH: 7.85, low organic matter and phosphorus content.

Tabe 1. Rainfall, temperature and total relative humidity values of Adana province in 2012-2013 and 2013-14 growing years

Month	Rainfall (mm)			Mean temperature C°			Relative humidity (%)		
	Mean	2012-2013	2013-2014	Mean	2012-2013	2013-2014	Mean	2012-2013	2013-2014
November	67,2	187	1,0	15,3	17,4	17,7	63	52,3	57,5
December	118,1	154,4	12,2	11,1	11,4	10,4	66	73,7	42,7
January	111,7	25,9	28,19	9,7	9,5	11,48	66	66,8	69,58
February	92,8	49,0	18,54	10,4	12,1	10,84	66	73,9	56,90
March	67,9	70,1	56,09	13,3	13,9	15,06	66	61,1	65,55
April	51,4	43,2	18,56	17,5	18,1	17,68	69	72	66,94
May	46,7	57,4	22,36	21,7	22,7	21,26	67	72,3	70,39
June	22,4	0.3	50,04	25.6	25.3	24,03	66	65.7	68,19
July	5,4	0.0	0,25	27,7	28.2	28,23	68	65.2	72,58

Table 1. The soil properties of experimental area.

Deep (cm)	Sandy (%)	Loam (%)	Caly (%)	pH	Kireç (%)	Org. Matter (%)	Total salt (%)	P_2O_5 (kg/da)
0-30	43.30	29.0	27.0	7.85	15.20	1.45	0.25	3.20

In this study, Thidiazuron, Ethephon + cyclanilide + Thidiazuron, Glyphosate and Ethephon + cyclanilide as plant regulators and İnci, Hasanbey, Seçkin, Aydın chickpea cultivars as plant material were used. Seeds were sown at two different sowing dates as winter (December) and early spring (February). Experiments were set out he randomized complete block design with 4 replications, seed was sown in 5 m length as six rows (13.5 m^2), and in row spacing with 45 cm and in row spacing 8 cm. Chemical fertilizers (30 N and 60 P_2O_5 kg/ha) were supplied before sowing.

Table 3. Chickpea varieties and chemical treatments used in the experiment

Chickpea genotypes Kontrol	Treatments	Content and dose	Effect
İnci	Thidiazuron	Droppultra(30cc/da)	defoliant
Hasanbey	Ethephon+cyclanilide+ Thidiazuron	Finish(175cc/da) + Droppultra(30cc/da)	defoliant
Seçkin	Glyphosate	Raundup (200cc/da)	plant dryer
Aydın	Ethephon+cyclanilide	Finish(175cc/da)	defoliant

In the experiment different plant growth regulators which effective substance content and plant drying or defoliating were tested. Plant growth regulators were applied at the maturity stage when 60-75% yellow/brown of pods. Observations were taken after harvest time. Glyphosate (200cc/da) (Roundup): Roundup contains glyphosate as the active ingredient which causes all kinds of plants to die and wilt. The composition of the preparation also includes substances that facilitate the penetration of glyphosate into plant tissues. Roundup is a non-selective herbicide, it also destroys weeds and grasses. Thidiazuron (30cc/da) (Droppultra) and Ethephon+cyclanilide (175cc/da) (Finish), defoliating agents, 6 hours after application are start to mature the plant, but plant get contiune growing. Germination test: Seeds were subjected to surface sterilization using sodium hypochlorite (5% v/v) for 10 minutes and then washed thrice with distilled water. Chemicals solutions were prepared by using a calculated applied in each petri-dish seeds. The seeds were placed Petri-dishes containing filter paper, each petri-dish consisted of 20 seeds. Day and night lengths were 18/6 h, with 24±1 °C at growth chamber.

Each variety was treated with a different chemical, and the sowing dates were arranged as two different trials in the study. Statistical analyses of recorded data were performed by employing by "the Kruskal Wallis Test" method in the SPSS package program.

Results and Discussion

The effects of chemical treatments on chickpea varieties sown winter season on some agricultural traits over two years were given Table 4. The effects of chemical treatments for number of empty and full pods and seeds $plant^{-1}$, and seed yield $plant^{-1}$ were significant. Thidiazuron (Inci variety) treatment was compared to control plots increased the number of total, full and empty pods $plant^{-1}$, wheares it were decreased the number of full pods and seeds $plant^{-1}$. Ethephon + cyclanilide + Thidiazuron (Hasanbey), Glyphosate (Seckin) and Ethephon+cyclanilide (Aydin) treatments were compared to control plots increased the number of total and empty pods $plant^{-1}$ except for number of empty pods $plant^{-1}$. Ethephon+cyclanilide, in Aydin variety, was more effective than other tratment for almost all traits. Generally, treatments decreased the number of empty pods $plant^{-1}$ that a good trait. The highest number of pods and seeds per plant (79,78-83,52 respectively) was in Ethephon+cyclanilide treatment of the Aydin variety, while the lowest number of pods per plant (47,12 -52,5 and 47,28-49,5 respectively) was in control groups of the Seckin and Hasanbey varieties. Number of full pods and seeds $plant^{-1}$ ranged from 41,96 in control group (Hasanbey) to 68,99 in Ethephon+cyclanilide (Aydin) treatment.

Table 4. Chemical treatments on chickpea varieties in Winter Sowing in 2012 and 2013 growing seasons (Mean ±se)

Varieties-traetments	Number of primary branches plant^{-1}	Number of secondary branches plant^{-1}	Number of pods plant^{-1}	Number of empty pods $^{-1}$	Number of full pods plant^{-1}	Number of seeds plant^{-1}	Seed yield plant^{-1}
İnci (C)	1,99±0,37	7,49±4,66	59,78±16,42ab	7,66±3,74 bcd	52,78±14,93ab	61,79±15,34ab	20,9±6,47ab
İnci (Thidiazuron)	1,62±0,48	6,58±4,18	61,37±30,56ab	8,32±5,82 bcd	50,28±21,35ab	59,91±28,61ab	20,67±11,54ab
Hasanbey (C)	1,79±0,59	7,14±4,35	47,28±9,83a	5,57±2,46abc	41,96±8,84a	49,5±12,64a	19,38±5,09a
Hasanbey (Ethephon+cyclanilide+ Thidiazuron)	1,66±0,49	6,2±3,11	51,46±27,17a	4,33±2,45ab	51,4±32,2ab	53,49±34,17a	20,78±11,65ab
Seçkin (C)	1,91±0,43	7,15±4,98	47,12±10,8a	5,02±2,24ab	42,6±9,8a	52,5±12,8a	19,6±5,6a
Seckin (Glyphosate)	1,87±0,58	6,1±3,97	50,7±18,9a	2,8±0,7a	47,9±18,5ab	57,5±23,6ab	21,96±8,86ab
Aydın (C)	1,66±0,28	8,36±4,46	66,56±21,13ab	9,24±4,39cd	57,33±18,13ab	68,7±22,6ab	24,29±9,22ab
Aydin (Ethephon+cyclanilide)	1,86±0,5	7,86±4,54	79,8±34,7b	10,79±4,4d	68,99±30,9b	83,5±35,9b	30,8±13,2b
Mean (control)	1,84±0,42	7,54±4,6	55,19±14,5	6,87±3,2	48,68±12,9	58,1±15,8	21,0±6,59
Mean (treatment)	1,75±0,51	6,69±3,95	60,84±27,83	6,57±3,36	54,64±25,75	63,60±30,56	23,55±11,31
P	0,731	0,967	0,05*	0,001**	0,05*	0,05*	0,05*
2012	1,92±0,46	10,76±2,12	52,13±24,02	6,55±4,26	45,86±20,45	54,48±26,06	19,44±9,91
2013	1,69±0,46	3,27±1,14	64,90±23,65	6,84±4,23	58,50±21,58	68,47±24,43	25,67±8,69
Mean	1,81.±0,46	7,02.±1,63	58,52±23,84	6,70.±4,25	52,18.±21,58	61,48.±24,43	22,56.±8,69
P	0,05*	0,0001**	0,03*	0,787	0,01**	0,03*	0,01**

The effects of chemical treatments on chickpea varieties sown early spring season on some agricultural traits over two years were given Table 5. The effects of chemical treatments for number of total and full pods and seeds plant^{-1} and seed yield plant^{-1} were significant. Thidiazuron (Inci), Ethephon + cyclanilide + Thidiazuron (Hasanbey) and Ethephon + cyclanilide (Aydin) treatments were significantly decreased all traits. The number of total and empty pods plant^{-1}, wheares it decreased the number of full pods and seeds plant^{-1}. All traits were increased by Glyphosate (Seckin) treatment. According to the average values, it was determined that the treatments increased the traits in early spring sowns. The highest number of pods per plant (62,9 and 62,6) was in control for İnci and in Glyphosate treatment for Seckin variety, also, Thidiazuron treatment had high number of pods per plant (61,6). The lowest number of pods per plant (38,5) was in Ethephon+cyclanilide + Thidiazuron treatment of Hasanbey variety. Seed yield plant^{-1} ranged from 14,8 g in Ethephon + cyclanilide + Thidiazuron (Hasanbey) and Ethephon + cyclanilide treatment to 25,2 g in Glyphosate treatment of Seckin variety. The effects of chemical treatments on chickpea varieties sown early spring season on germination ratio were given Table 6. The effects of chemical treatments on germination ratio were only significant at 2012 in early spring sown. Thidiazuron (Inci) and Glyphosate (Seckin) treatments were negatively affect the germination ratio. Ethephon + cyclanilide + Thidiazuron (Hasanbey) treatment was increased it. Although the lowest germination ratio (39,38%) was in Thidiazuron (Inci), Seckin (control) had the highest value (77,5%). However, general mean value (57,66%) was higher than control one (53,91%). Veeranna et al. (2020) in India, tested some defoliants (Glyphosate+ Ammonium sulfate, Paraquat, urea, ZnSO4, MnSO4, Mncl spraying) and they have conducted a study with water as control on physiological pod ripeness of green gram. The number of leaves/m^2 was determined on 3, 5, 7 and 10 days before and after the defoliant application. In addition, the germination ratio of the harvested seeds was tested. Spraying paraquat at 4 ml/l at physiological pod maturity resulted in the drying and falling of 92% of the leaves within 3 days of application and 100 percent of them 7 days after spraying. This application was followed by the application of 8 ml/l glyphosate (93% defoliation within 7 days and 99% defoliation within 10 days). Defoliant residue was not detected in seeds and plants, and the germination percentage of seeds was not affected. Math (2018) conducted a field trial examining the effect of paraquat on the productivity of mechanical and manual harvesting of defoliated mung bean genotypes in India. The

experiment was conducted in two main plots (harvest methods), three subplots (genotype) and two sub-subplots (paraquat spray and control). Harvest methods and genotypes did not differ significantly in yield, but the application of paraquat spray was significant compared to the control produced significantly higher seed yield (1,269 kg/ha). Mechanical harvesting of all three genotypes by paraquat resulted in significantly high seed yield (1,304-1,245 kg/ha), field yield (91,79–90,45%), harvest yield (521–498 kg/ha). Significantly higher threshing loss (5,90-5,19%) was detected in mechanical harvesting without paraquat spraying. Mechanical harvesting also provided the advantage of lower harvest labor cost.

Table 5. Chemical treatments on chickpea varieties in early spring in 2012 and 2013 growing seasons (Mean ±se)

Varieties-traetments	Number of primary branches plant^{-1}	Number of secondary branches plant^{-1}	Number of pods plant^{-1}	Number of empty pods $^{-1}$	Number of full pods plant^{-1}	Number of seeds plant^{-1}	Seed yield plant^{-1}
İnci (C)	2,03±1,13	15,4±14,8	62,9±28,0b	7,29±3,68	55,3±26,8ab	64,2±32,54ab	22,4±13,34ab
İnci (Thidiazuron)	2,24±1,37	13,3±13,1	61,6±21,0b	7,25±4,92	52,9±18,7ab	61,5±25,07ab	18,6±7,9ab
Hasanbey (C)	2,2±1,03	12±9,8	56,7±18,2ab	6,7±5,7	50,5±14,5ab	54,7±14,97ab	19,4±5,2ab
Hasanbey (Ethephon +cyclanilide+ Thidiazuron)	2,36±1,05	12,5±10,9	38,5±20,4a	4,94±2,67	37,1±14,2a	42,7±15,18a	14,8±5,1a
Seçkin (C)	1,66±0,59	9,7±8,23	48,7±16,0ab	4,01±2,7	44,7±14,6ab	52,8±16,4ab	18,4±5,3ab
Seckin (Glyphosate)	1,95±0,97	12,47±9,7	62,6±16,8b	4,19±2,38	58,5±15,6b	67,1±20,6b	25,2±7,5b
Aydın (C)	1,87±0,87	14,3±13,4	56,8±17,0ab	8,37±5,8	48,8±12,8ab	64,4±19,0ab	19,3±5,9ab
Aydin (Ethephon +cyclanilide)	1,7±0,39	8,87±6,81	47,6±14,1ab	6,5±4,97	41,1±12,5ab	49,2±15,6ab	14,8±5,3a
Mean (control)	2,07±0,95	11,8±10,1	52,6±18,1	5,72±3,7	47,4±15,2	55,14±19,12	18,36±6,46
Mean (treatment)	1,94±0,91	12,3±11,6	56,27±19,82	6,59±4,5	49,82±17,2	59,06±20,7	19,88±7,42
p	0,808	0,95	0,05*	0,413	0,05*	0,05*	0,05*
2012	2,74±0,81	21,4±7,6	57,13±23,67	6,3±3,88	50,83±21,7	61,03±26,5	20,21±8,7
2013	1,27±0,25	3,16±1,4	51,73±15,47	6,08±4,82	46,39±11,14	53,17±13,32	18,03±6,58
Mean	2.01±0,5	12,3±4,5	54,43±19,57	6,19±4,35	48,61±16,4	57,1±19,9	19,12±7,64
p	0,001**	0,001**	0,284	0,846	0,307	0,139	0,263

Table 6. Chemical treatments on chickpea varieties for germination ratio at winter and early spring sown dates in 2012 and 2013 growing seasons (Mean ±se)

	Winter		Early spring	
Varieties-traetments	2012	2013	2012	2013
İnci (C)	95±5,77	99,25±0,96	50,0±29,44ab	100±0
İnci (Thidiazuron)	98,13±2,39	99,75±0,5	39,38±29,47a	100±0
Hasanbey (C)	97,5±5	99,25±0,96	47,5±17,08ab	100±0
Hasanbey(Ethephon+cyclanilide+ Thidiazuron)	96,88±1,25	99,75±0,5	58,13±21,83ab	99,75±0,5
Seckin (C)	100±0	99,25±0,5	77,5±20,62b	99,75±0,5
Seckin(Glyphosate)	96,88±3,15	98,25±2,22	61,88±22,67ab	100±0
Aydın (C)	98,13±2,39	99,75±0,5	55,63±7,74 ab	100±0
Aydin (Ethephon+cyclanilide)	98,13±2,39	99,75±0,5	56,25±5,95ab	99,75±0,5
Mean (control)	97,505±2,30	99,375±0,93	53,91±19,98	99,875±0,25
Mean (treatment)	97,66±3,29	99,38±0,73	57,66±18,72	99,94±0,125
p	97,58±3,2	99,38±1,0	55,78±21,36	99,61±21,37
Test Statistics[a,b]	2012	2013	2012	2013
Chi-Square	6,413	5,937	5,345	6,573
df	7	7	7	7
Asymp. Sig.	0,492	0,547	0,05*	,475
a. Kruskal Wallis Test				
b. Grouping Variable: Cultivar				

Conclusion

In the combined analyses of chickpea cultivars in winter and early spring sowing in 2012-2013 and 2013-2014 years, the effect of some chemical on chickpea varieties for the total number of pods, the number of empty pods, the number of full pods, the number of seeds and the seed yield were statistically significant. It has been determined that sowing date, cultivar differences, and chemical applications have no effect on germination percentages in winter and early spring sowings, in Inci, Hasanbey, Seckin, Aydin chickpea cultivars with and without chemical application. Within 6 hours of Glyphosate (200cc/da) (Roundup) application, communication with the soil is cut off, nutrient exchange ends, it matures directly; Thidiazuron (30cc/da) (Droppultra) and Ethephon+cyclanilide (175cc/da) (Finish) applications stop the development of plants by shedding their leaves; The maturation of the seeds continues, and the development of the seeds continues. If chemicals are required, it is more suitable for seed health in Thidiazuron (30cc/da) (Droppultra) and Ethephon+cyclanilide (175cc/da) (Finish) applications. However, this study needs to be supported by multi-year studies in different climate conditions, at different doses.

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Contribution Rate Statement Summary: The authors declare that they contributed equally to this article.

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