Response of soybean cultivars to weed control treatments

Ibrahim Mohamed El-Metwally[1*], Tarek Abd Elfattah Elewa[2], Mona Gergis Dawood[1]

(1. *Botany Department, National Research Centre, 33 El-Tahrir St., Dokki, 12622 Giza, Egypt*;

2. *Agromony Department, National Research Centre, 33 El-Tahrir St., Dokki, 12622 Giza, Egypt*)

Abstract: Two field experiments were conducted in two successive seasons, 2015and 2016, at the experimental farm of the National Research Centre at Nubaria, Egypt, during summer seasons to determine weed management can improve soybean competitiveness with weeds, thus helping to achieve its yield potential. The experiment included three soybean cultivars (Giza 111, Giza 21 and Crawford) and six weed control treatments, including oxadiargyl, butralin, metribuzin, bentazone + clethodium, a nonweeded (control) and two hand-treatment. Great reduction in dry weight of broadleaved, grassy and total weeds after 60 and 90 days from sowing was noticed in the plots cultivated with Giza 111 cultivars. Also, Giza 111 cultivars markedly produced greater plant height, SPAD, NAR, SLA, LWR and RGR at 60 and 90 days from sowing as well as yield, yield attributes and chemical composition of soybean seeds. Two hand-hoeing achieved the highest weed depression expressed in the lowest dry matter of broadleaved, narrow-leaved and total weeds. Also, two hand-hoeing was the most superior treatment in increasing plant height, SPAD, NAR, SLA, LWR and RGR at 60 and 90 days from sowing as well as yield, yield attributes and chemical composition of soybean seeds. Two hand-hoeing or herbicide bentazone + clethodium integrated with Giza111 cultivar produced the maximum values of plant height, NAR, seed yield and oil percentage. It could be concluded that two hand-hoeing or herbicide bentazone + clethodium combined with Giza 111 cultivars recorded effectively improve growth and productivity of soybean under sandy soil conditions.

Keywords: herbicides, two hand-hoeing, growth, yield, oil percentage

Citation: El-Metwally, I. M., T. A. E. Elewa, and M. G. Dawood. 2017. Response of soybean cultivars to weed control treatments. Agricultural Engineering International: CIGR Journal, Special issue: 159–165.

1 Introduction

Egypt is one of the largest countries imported oil on the world level, where it is importing more than 90% of the needs of the oil from abroad. Therefore, care must be taken to increase the productivity of oil crops. Soybean (*Glycine max* (L.) Merrill) is considering one of the most important oil crops. Soybean is important on a global tier food and industrial crops du% protein with a nutritional value close to the value of animal protein. Soybean seeds contain about 20% oil, carbohydrate content of up to 35% and about 35%-40% protein. State policy currently depending on increasing the productivity of soybean to reduce import by increasing the production per unit area (vertical expansion) and horizontal expansion through the newly reclaimed lands. The vertical expansion could be possible via developing high – yielding varieties and improving cultural practices especially weed control treatments. Soybean varieties differ in productivity, according to its response to the surrounding environmental conditions of various agricultural and competitiveness in weed control (Rezvani and Zaefarian, 2012; Ahadiyat and Sarjito, 2011; Guilherme et al., 2015). Soliman et al. (2015) reported that Giza 111varieties suppressed the growth of weed under investigation compared to other varieties and increased soybean seed yield by 6.67%.

Weed control plays an important role in raising the productivity of crops. The presence of weeds is causing a shortage of the crop up to 40% (Soliman et al., 2015). At present, hand hoeing became more expensive than the use of herbicides. Herbicides are cheaper and easier is to use weed control than the hoeing. Thus, chemical weed

Received date: 2017-06-04 **Accepted date:** 2017-12-29

*** Corresponding author: Ibrahim Mohamed El-Metwally,** Professor of Botany Department, Research Department, National Research Centre. Email: monagergis@yahoo.com. Tel: (+202) 33371363, Fax: (+202)33370931c.

control is necessary to decrease cost and to increase soybean productivity. This crop is a large herbicide consumer, and almost 100% of the planted area in Egypt is herbicide-treated. The advantages of herbicide application are characterized by high efficiency in weed control, high selectivity and at the lowest cost, compared to other available weed control methods. Soliman et al. (2015) indicated that weed control treatments reduced dry weight of broadleaved, grassy and total weeds compared with unweeded treatments. Abd El-Hamed and El-Metwally (2008) reported that hand hoeing twice scored the lowest value of all weed species and gave the highest values of yield and yield attributes of soybean. Hence, two field experiments were conducted to evaluate the effects of different weed control treatments on yield and yield attributes of soybean genotypes and associated weeds.

2 Materials and Methods

Two field experiments were conducted during the two successive seasons 2015 and 2016 at the experimental research and production station of National Research Centre, Nubaria region, Egypt (latitude 30.8667 N, and longitude 31.1667 E, and mean altitude 21 m above sea level). The experimental area was classified as arid region with cool winters and hot dry summers prevailing in the experimental area. Some physical and chemical properties of the experimental soil are shown in Table 1. The experiment was established with a split plot design having four replicates. The main plots included three soybean varieties (Giza 111, Giza 21 and Crawford). Sub-plots were assigned to six weed control treatments. The common, trade and chemical names as well as the rate of application of the herbicides used are shown in Table 2. The experimental field was deep ploughed before planting. First disc harrow, then duck food was used for further preparation of the field for planting. The experimental unit was 3.5 X 3.0 m. Soybean bean seeds were inoculated with the specific Rhizobium strain and immediately sown in hills 25 cm apart on both sides of the ridge (150 kg ha^{-1}). Sowing dates were May18 and 25 for the two seasons 2015 and 2016, respectively.

Table 1 Soil physical chemical characteristics of experimental site

Soil depth, cm	Particle size distribution, %			Texture class	Chemical properties			
	Coarse sand	Fine sand	Clay + Silt		OM [%]	pH (1:2.5)	EC [dSm^{-1}]	CaCO3 [%]
20	46.11	48.63	5.26	Sandy	0.70	8.5	0.32	6.56
40	54.23	39.12	6.65	Sandy	0.45	8.7	0.30	2.51
60	56.17	37.14	6.69	Sandy	0.30	9.1	0.42	4.75

Note: OM= Organic matter; pH= acidity or alkalinity in soils; EC= electrical conductivity.

Table 2 Trade and chemical names; rate and time of application of herbicides used

Trade name	Common name	Chemical name	Rate of application	Time of application
Topstar 400 SC	Oxadiargyl	[3-(2, 4-dicloro-5-(2-Propynyloxy) phenyl)-5- (1, 1-dimethylethyl)-1, 3, 4, oxdiazol-2(3H)-one]	600 g ha^{-1}	After planting and before irrigation
Sencor 70	Metribuzin	(4-amino-6-tert-butyl-3-(methylthio)-as-triazin-5(4H)-one)	750 g ha^{-1}	
Amex 820	Butralin	[4-(1, 1dimethylethyl)-N-1-methyl propyl)-2, 6-dinitrobenzenamine]	6 L ha^{-1}	
Basagran 480 SL	Bentazone	(3-isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide)	1.25 L ha^{-1}	After 20 days from sowing
Select supper	Clethodium	(±)-2-[(E)-1-[(E)-3- chloroallyloxyimino]propyl]-5-[2-(ethylthio)propyl]-3- hydroxycyclohex-2-enone	0.625 L ha^{-1}	After 30 days from sowing

All treatment plots received the same amount of total fertilizer. A compound fertilizer was applied as follow: Nitrogen fertilizer as ammonium nitrate (33.5% N) at the rate of 50 kg Nha^{-1} was added after 20 days from sowing, phosphorus fertilizer was applied in the form of single super-phosphate (15.5% P_2O_5) during land preparation at the rate of 357 kgha^{-1} and 150 kgha^{-1} potassium sulphate (48% K_2O) applied once after 35 days from sowing.

2.1 Measurements

2.1.1 Physiological and morphological characters

Ten plants were selected at random from the inner rows of each sub-plot at 60 and 90 days after sowing to determine the relative growth rate and its components. At each time, plants were excised at ground level for separation into above ground (leaves, stems and reproductive organs) and below ground portions (roots).

To remove soil particles and plant debris from the root surface, the below ground portion was washed carefully under tap water. Leaves, stems, reproductive organs and roots were oven-dried at 70°C for 72 hrs and their dry weights were measured. Leaf areas were measured for each plant by applying the disk method. Plant growth was evaluated based on the estimated relative growth rate (RGR), and its components, net assimilation rate (NAR), specific leaf area (SLA) and leaf weight ratio (LWR) by the interval method from 60 (T1) to 90 DAS (T2). RGR, NAR, LWR, and SLA were calculated in the two harvests according to Hunt (1982) as follows:

1- Net assimilation rate (NAR $gmcm^{-2}$ /week) was determined as follow:

$$NAR = \frac{W2 - W1 ? Loge\ LA2 - Loge\ LA1}{LA2 - LA1 ? T2 - T1}$$

where, NAR (mg cm^{-2}/week) is the net dry matter productivity per unit leaf area per unit time; LA is leaf area, W is total dry matter and T is time.

2- Specific leaf area (SLA)

$$SLA = \frac{LA1/W1 + LA2/W2}{2}$$

where, SLA is leaf area per unit leaf weight, $cm^2\ g^{-1}$.

3- Leaf weight ratio (LWR)

$$LWR = \frac{\{(Leaf\ DW(1)/Total\ DW(1)\} + \{(Leaf\ DW(2)/Total\ DW(2)\}}{2}$$

where, LWR (dimensionless) is the ratio of leaf dry weight to plant dry weight.

4- Relative growth rate (RGR) was factorized as follows:

$$RGR = NAR \times SLA \times LWR$$

5- Plant height (cm)

6- SPAD value of fourth faba bean leaves was determined by according to chlorophyll meter (SPAD-502, Minolta Camera Co., Osaka, Japan, Minolta Co., 2013).

At harvesting, the following data were recorded:

1. Number of pods / plant.
2. Pods dry weight / plant (g).
3. Seeds weight / plant (g).
4. Number of seeds / plant
5. 100- seed weight (g)

Seed yield (ton ha^{-1}) for the last traits the two central ridges of each experimental unit were devoted the determination.

2.1.2 Chemical composition of seeds

The oil content of the seeds was determined according to the procedure reported in AOAC (1990). The defatted meals were used for determination of the protein content by microkjeldahl method according to (AOAC 1990). Total phenolic compounds were determined colorimetrically according to the method defined by Snell and Snell (1953) using Folin Ciocalteu phenol reagent. The free radical scavenging activity was determined according to Brand-Williams et al. (1995) using 1.1-diphenyl-2-picrylhydrazil (DPPH) reagent.

2.1.3 Statistical Analyses

The combined analysis of variance for the data of the two seasons was performed after testing the error homogeneity and Fisher's Least Significant Difference (LSD) method at 0.05 level obtained data from each season were subjected to the proper statistical analysis of variance of significance was used for the comparison between means according to Gomez and Gomez ,1984.

3 Results and Discussion

3.1 Weed growth

The dominant weeds in the experimental field in the two seasons were: broadleaved, namely, Common purslane (*Portulaca oleraceae*), Nalta jute (*Corchorus olitorius*) and Venice mallow (*Hibiscus trionum*). While the major grass weeds were: Jungle rice (*Echinochloa colonum*), Bermudagrass (*Cynodon dactylon*) and Purple nutsedge (*Cyperus rotundus*).

3.2 Varietal performance

The results of three cultivars presents in Table 3 showed significant effect on dry weight of broadleaved, grassy and total weeds after 60 and 90 days from sowing. Giza 111cultivar recorded the lowest values of the previous characters. Reduction of weeds growth in Giza 111 fields may be due to produce the highest vegetative growth soybean plant as shown in Table 4 which in turn exerts great competition of weeds compared with other cultivars. Giza 21 cultivars came in the second followed by that of Crawford. Our findings are consistent with those obtained by Soliman et al. (2015).

3.3 Effect of weed managements

Data in Table 3 clearly indicated that treatment of two hand-hoeing was more efficient and exerted the highest reduction in dry weight of broadleaved, grasses and total weeds. Therefore, it decreased dry weight of aforementioned characters 89.50%, 88.47% and 88.92% after 60 days from sowing as well as 89.15%, 87.82% and 88.39% after 90 days from sowing. Bentazon+ Clethodium came in the second rank after two hand-hoeing followed by that of oxadiargyl, butralin and metribuzin treatments. Several reports have confirmed that hoeing twice is the most effective weed control practice for reducing weed dry matter accumulation in soybean fields. Thus, bentazon+clethodium was more effective in controlling total weeds and resulted in the highest reduction of dry matter when compared with oxadiargyl, butralin and metribuzin. The reduction of weed dry weight may be due to the inhibition effect of herbicide treatments on growth and development of weeds. No significant differences between application of two hand-hoeing and bentazon+ clethodium treatments on growth weeds. These results are in general agreement with those recorded by Ahmed et al. (2001), Singh and Jolly (2004), Abd El-Hamed and El-Metwally (2008), Soliman et al. (2015).

Table 3 Effect of soybean variety and weed control on dry weight of soybean weeds gm^{-2} at 60 and 90 days from sowing (combined analysis of two seasons)

Treatments	At 60 days from sowing			At 90 days from sowing		
	Broadleaved	grasses	Total	Broadleaved	grasses	Total
Variety						
Giza 21	76.05	104.42	180.47	163.82	231.98	395.80
Crawford	78.67	105.93	184.60	198.30	277.97	479.27
Giza 111	72.27	101.27	173.54	138.02	199.47	337.49
LSD 0.05	1.77	3.11	4.57	3.45	4.77	7.53
Weed control treatments						
Oxadiargyl	9.40	13.44	22.84	129.80	189.13	318.93
Butralin	11.71	15.20	26.91	150.86	213.47	364.33
Metribuzin	13.14	15.39	28.53	141.27	242.77	384.04
Bentazon + clethodium	7.21	8.99	16.20	74.83	101.23	176.06
Hand hoeing Twice	4.85	6.50	11.36	49.30	72.97	122.27
Unweeded	44.09	53.34	97.42	454.23	599.27	1053.50
LSD 0.05	3.17	2.56	4.11	5.23	7.89	11.45

The results in Table 5indicated that the interaction between soybean cultivars and weed control treatments on dry weight of total weeds after 60 and 90 days from sowing were significant. The obtained results verified that two hand-hoeing treatments with Giza 111cultivar were highly efficient of decreasing dry weight of total weeds as compared with other treatments. On the other side, unweeded chek with Crawford cultivar gave the highest values of dry weight of total weeds. These results are in accordance with those recorded by Guilherme et al. (2015); Ahadiyat and Sarjito (2011).

3.4 Soybean physiological and morphological characters

3.4.1 Varietal performance:

Average of plant height, SPAD value, NAR, SLA, LWR and RGR as affected by soybean cultivars are shown in Table 4. The three tested cultivars significantly different in aforementioned characters. The results indicated that Giza 111 had greatest plant height, SPAD value, NAR, SLA, LWR and RGR if compared with Giza 21 and Crawford cultivars. While, Crawford cultivars gave the lowest previous characters when compared with the other cultivars. These results may be due to superiority of Giza 111 in traits under study to increase vegetative growth, plant height and thus increase its competitiveness with weeds compared to the rest of the varieties. The results of the present investigation are in trend with those obtained by Rezvaniet al. (2012), Soliman et al. (2015).

3.4.2 Effect of weed managements

Data presented in Table 4 shows the effect of weed control treatments on growth and physiological characters of soybean plants after 60 and 90 days from sowing. Data clear that all weed control treatments significantly increased growth and physiological characters of soybean plants as compared with unweeded treatments. Maximum values of plant height, SPAD value, NAR, SLA, LWR and RGR were obtained by two hand-hoeing followed by that of bentazon+clethodium, oxadiargyl, butralin and metribuzin treatments. The other side, the lowest value was recorded when soybean plots were unweeded. The superiority of the previous treatments in growth and physiological characters are attributed to their high efficiency in controlling soybean weeds and consequently improving growth characters of soybean plants. These results are in general agreement with those recorded by Kushwah and Vyas (2005), Peer et al. (2013), and Lamptey et al. (2015).

Table 4 Effect of soybean variety and weed control on growth and physiological parameters of soybean at 60 and 90 days from sowing (combined analysis of two seasons)

Treatments	Plant height, cm	SPAD value	NAR	SLA	LWR	RGR
Variety						
Giza 21	95.43	39.46	3.70	0.35	0.36	0.49
Crawford	94.06	39.99	3.63	0.32	0.34	0.46
Giza 111	96.03	40.68	3.75	0.37	0.39	0.54
LSD 0.05	1.23	0.43	0.08	0.01	0.01	0.02
Weed control treatments						
Oxadiargyl	95.38	40.39	3.73	0.35	0.37	0.52
Butralin	95.10	40.00	3.66	0.35	0.36	0.51
Metribuzin	94.60	39.28	3.62	0.34	0.36	0.51
Bentazon + clethodium	95.98	41.03	3.84	0.36	0.37	0.53
Hand hoeing Twice	97.77	42.90	4.03	0.36	0.37	0.53
Unweeded	92.20	36.68	3.27	0.32	0.34	0.37
LSD 0.05	1.55	0.78	0.05	0.01	0.01	0.02

Data in Table 5 showed that there was a significant effect due to the interaction between soybean cultivars and weed control treatments on NAR at 60 and 90 days from sowing. Cultivation of Giza 111 and application of two hand-hoeing produced the highest values of NAR. While, the lowest values of NAR were recorded with unweeded treatment with cultivation of Crawford cultivars. These results are in accordance with those recorded by Abd El- Hamed and El-Metwally (2008).

3.5 Yield and yield attributes

3.5.1 Varietal performance

The results in Table 6 indicated that the effect of three soybean cultivars on yield and yield attributes was significantly number of pods / plant, pods dry weight / plant, seeds weight / plant, 100-seed weight and seed yield ton ha^{-1}. Giza 111 cultivars gave the better values of the previous characters as compared to other cultivars. This increase in seed yield amounted to 6% more than Crawford cultivars. In this regard, the increase in Giza 111 seed yield may be due to increase the vegetative growth, which led to an increase yield components resulting in increased plant seed yield compared to the rest of the varieties. These results are in coinciding with those detected by Rezvani et al. (2012), Soliman et al. (2015).

Table 5 Effect of the interaction between soybean variety and weed control on dry weight of total weeds and NAR (combined analysis of two seasons)

Treatments		Total dry weight of weeds, g m^{-2}		NAR
Variety	Weed control	At 60 Days	At 90 Days	
Giza 21	Oxadiargyl	121.50	311.8	3.75
	Butralin	143.83	351.4	3.65
	Metribuzin	148.70	379.2	3.61
	Bentazon + clethodium	80.47	168.6	3.85
	Hand hoeing Twice	59.93	120.7	4.06
	Unweeded	528.37	1043.1	3.27
Crawford	Oxadiargyl	123.43	381.7	3.65
	Butralin	146.57	440.3	3.61
	Metribuzin	153.20	461.3	3.59
	Bentazon + clethodium	83.40	675.1	3.75
	Hand hoeing Twice	62.53	151.4	3.94
	Unweeded	538.47	1209.3	3.21
Giza 111	Oxadiargyl	117.33	263.3	3.79
	Butralin	138.47	301.3	3.72
	Metribuzin	143.33	311.6	3.65
	Bentazon + clethodium	75.50	249.5	3.92
	Hand hoeing Twice	52.67	94.8	4.10
	Unweeded	513.93	908.1	3.33
	LSD 0.05	6.68	11.89	0.11

3.5.2 Effect of weed managements

Weed control treatments had significant effects on yield and yield attributes of soybean Table 6. Application of two hand-hoeing statistically increased number of pods / plant, pods dry weight / plant, seeds weight / plant, 100-seed weight and seed yield tonha^{-1} compared to other treatment. Bentazon+clethodium came in the second rank followed by that of oxadiargyl, butralin and metribuzin treatments. The increases in grain yield resulting from previous treatments amounted to 39.00%, 32.76%, 27.24%, 24.82% and 21.38%, respectively. In contrast, the lowest values of aforementioned characters were recorded with the unweeded plots. The increase in yield attributes by different weed control treatments may be due to good control of soybean weeds and minimizing weed competition which gave a good chance of soybean growth and improved the yield attributes as well as seed yield. The results of the present investigation are in trend with those obtained by Pandya et al. (2005), Dawood et al. (2016), El-Metwally (2016), El-Metwally and Dawood (2016).

Data in Table 7 shows that there was a significant effect of the interaction between weed control treatments and soybean cultivars on seed yield. The cultivation of Giza 111 and application of two hand-hoeing or bentazon+clethodium as post emergence produced the highest seed yield. On the contrary, the unweeded treatment showed the lowest seed yield. Similar results have been reported by Behera et al. (2004), Rezvani et al. (2012), and Soliman et al. (2015).

Table 6 Effect of soybean variety and weed control on yield and chemical composition of seed (combined analysis of two seasons)

Treatments	Yield and yield components						Chemical composition			
	No. of pods /plant	Pod dry weight, g	No. of seed/ plant	Seed weight / plant, g	100- seed weight, g	Seed yield, ton ha^{-1}	Prot-ein, %	Oil, %	Antiox-idant, %	Phen-olic, Mg g^{-1}
Variety										
Giza 21	36.74	19.37	55.60	17.08	16.93	3.61	35.78	24.76	47.80	27.55
Crawford	34.84	17.23	52.48	14.19	15.26	3.49	37.14	25.08	43.63	24.13
Giza 111	39.48	21.23	58.94	20.23	18.60	3.71	36.49	25.92	37.45	32.16
LSD 0.05	1.01	1.23	1.42	2.17	0.57	0.03	0.71	0.35	2.14	1.23
Weed control treatments										
Oxadiargyl	37.84	20.41	57.97	17.98	17.39	3.69	36.64	25.50	43.50	28.30
Butralin	36.90	19.50	57.04	17.32	16.94	3.61	36.22	25.20	42.87	27.73
Metribuzin	36.43	18.93	56.61	16.82	16.53	3.52	35.98	24.96	42.27	26.97
Bentazon + clethodium	42.86	21.57	60.60	19.16	17.89	3.85	37.29	25.88	43.93	29.17
Hand hoeing Twice	44.20	22.91	63.73	20.16	18.16	4.02	37.69	26.44	44.77	29.67
Unweeded	23.88	12.34	38.08	11.57	14.66	2.93	35.01	23.54	40.43	25.87
LSD 0.05	1.19	2.11	3.23	1.89	0.46	0.03	0.81	0.19	1.01	1.12

Table 7 Effect of the interaction between soybean variety and weed control on Seed yield and oil after 90 days from sowing (combined analysis of two seasons)

Treatments		Seed yield, ton ha^{-1}	Oil, %
Variety	Weed control		
Giza 21	Oxadiargyl	3.64	25.03
	Butralin	3.61	24.83
	Metribuzin	3.52	24.50
	Bentazon + clethodium	3.79	25.17
	Hand hoeing Twice	4.00	26.00
	Unweeded	3.10	23.00
Crawford	Oxadiargyl	3.55	26.00
	Butralin	3.51	25.67
	Metribuzin	3.40	25.67
	Bentazon + clethodium	3.73	26.70
	Hand hoeing Twice	3.80	27.07
	Unweeded	2.92	24.43
Giza 111	Oxadiargyl	3.86	25.47
	Butralin	3.71	25.10
	Metribuzin	3.64	24.70
	Bentazon + clethodium	4.02	25.77
	Hand hoeing Twice	4.26	26.27
	Unweeded	2.78	23.20
LSD 0.05		0.07	0.36

3.6 Chemical composition of seeds

Results indicated that three soybean cultivars significantly differ in percentages of oil, protein, antioxidant and phenolic mg g^{-1} as shown in Table 6. Giza 111 cultivars gave the better values of the oil, protein and phenolic as compared to other cultivars. While, Giza 21 gave the maximum values of the antioxidant as compared to other cultivars. On contrast, Crawford cultivar produced the lowest previous characters when compared with the other cultivar. Similar trend was reported by Rezvani et al. (2012), Soliman et al. (2015).

3.7 Effect of weed managements

Data in Table 6 reported that all weed control treatments caused significant increases in percentages oil, protein, antioxidant and phenolic mg g^{-1} over the unweeded check. Maximum values of oil, protein, antioxidant and phenolic were obtained by two hand-hoeing followed by that of bentazon+ clethodium, oxadiargyl, butralin and metribuzin treatments. In this regard, no significant differences between herbicides treatments. The other side, the lowest values of aforementioned characters was recorded when soybean plots were unweeded. The aforementioned increases in oil, protein, antioxidant and phenolic mg g^{-1} in soybean seeds may be due to less competition for environmental factors, particularly nutrients, water and light through limiting weeds infestation with herbicidal treatments due to increasing the uptake of different nutrients and reflected on chemical composition of seeds. The positive effect of weeded practices on chemical analysis of soybean seeds have been confirmed by Ahmed et al. (2001), Abd El-Hamed and El-Metwally (2008), El-Metwally (2016).

4 Conclusions

It could be concluded that two hand-hoeing or herbicide bentazone + clethodium combined with Giza 111 cultivars recorded effectively improve growth and productivity of soybean under sandy soil conditions.

References

Abdelhamid, M. T., and I. M. El-Metwally. 2008. Growth, nodulation and soybean and associated weed as affected by weed management. *Plant Daninha*, 26(4): 855–863.

Ahadiyat, Y. R., and A. Sarjito. 2011. Performance of two soybean (*Glycine Max* L. Merr) cultivars in different weeding time under no tillage. *Research Journal of Agricultural Science*, 43(4): 5–11.

Ahmed, S. A., S. A. S. El-Din, and I. M. El-Metwally. 2001. Influence of some microelements and some weed control treatments on growth, yield and yield components of soybean. *Annals of Agriculture Science, Moshtohor*, 39(2): 805–823.

AOAC. 1990. *Official Methods of Analysis of the Association of Official Edition*. Washington, D.C: AOAC.

Behera, U. K., U. Singh, and Y. V. Singh. 2005. Influence of weed control on productivity of soybean (*Glycine max*) in vertisol of central India. *Indian Journal of Agronomy*, 50(3): 221–224.

Cottenie, A., M. Verloo, L. Kiekens. 1982. *Chemical Analysis of Plant and Soils*. Ghent, Belgium: State UnivLab. Agrochem.

Dawood, M. G., I. M. El-Metwally, and M. T. Abdelhamid. 2016. Physiological response of lupine and associated weeds grown at salt-affected soil to α-tocopherol and hoeing treatments. *Gesunde Pflanzen,* 68(2): 117–127.

El-Metwally, I. M. 2016. Efficiency of some weed control treatments and some bio-stimulants on growth, yield and its components of faba bean and associated weeds. *International Journal of Pharm Tech Research,* 9(12): 165–174.

El-Metwally, I. M., and M. G. Dawood. 2016. Response of faba bean plants to weed control treatments and foliar spraying of some bio-stimulants under sandy soil condition. *International Journal of Pharm Tech Research*, 9(12): 155–164.

Gomez, K. A., and A. A. Gomez.1984. *Statistical Procedures for Agriculture Research.* New York, USA: A Wiley- Inter Science Publication, John Wiley & Sons, Inc.

Guilherme, F., A. T. Bruzi, A. M. Zuffo, E. V. Zambiazzi, I. O. Soares, P. M. de Rezende, and F. B. S. Botelho. 2015. Agronomic performance of RR® soybean cultivars using different pre-sowing desiccation periods and distinct post-emergence herbicides. *African Journal of Agricultural Research*, 10(34): 3445–3452.

Hunt, R. 1982. *Plant Growth Curves: The Functional Approach to Plant Growth Analysis.* London: Edward Arnold.

Kushwah, S. S., and M. D. Vyas. 2005. Herbicides weed control in soybean (*Glycine max*). *Indian Journal of Agronomy*, 50(3): 225–227.

Lamptey, S., S. Yeboah, K. Sakodie, and A. Berdjour. 2015. Growth and yield response of soybean under different weeding regimes. *Asian Journal of Agriculture and Food Sciences,* 3(2): 155–163.

Minolta, C. 2013. *Manual for Chlorophyll Meter SPAD-502 plus.* Osaka, Japan: Minolta Camera Co.

Pandya, N., G. S. Chouhan, and V. Nepalia. 2005. Effect of varieties, crop geometries and weed management on nutrient up take by soybean (*Glycine max*) and associated weeds. *Indian Journal of Agronomy*, 50(3): 218–220.

Peer, F. A., B. Hassan, B. A. Lone, S. Qayoom, L. Ahmad, B. A. Khanday, P. Singh, and G. Singh. 2013. Effect of weed control methods on yield and yield attributes of soybean. *African Journal of Agricultural Research*, 8(48): 6135–6141.

Rezvani, M., M. Ahangari, and F. Zaefarian. 2012. Effect of cultivars and weeding regimes on soybean yields. *International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering*, 6(9): 714–716.

Singh, G., and R. S. Jolly. 2004. Effect of herbicides on the weed infestation and grain yield of soybean (*Glycine max*). *Acta Agronomy Hungarica*, 52(2): 199–203.

Soliman, I. E., A. R. Morsi, and A. E. Khaffagy. 2015. Effect of competitive abilities of some soybean genotypes, plant densities and weed control treatments on soybean (*Glycine Max* L. Merr) and its associated weeds. *Journal of Plant production*, 6(8): 1413–1429.