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Effect of weed control on yield, yield components and quality characteristics of soybean crop (*Glycine max* L.).

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ABSTRACT
A field experiment was conducted in the Kurdistan Region of Iraq for the agricultural season 2022-2023 in the fields of the Agricultural Research Station in Erbil - Ain Kawa Governorate, Lat. 36014'51.0"N, long. 43059'50.5"E). In order to the effect of herbicides (Imazethapyr and a mixture of Bentazone + Gallant Super) and their recommended dose for each of these herbicides and the spraying at four periods (two, four, six and eight weeks) after germination for the soybean crop, (Shaimaa cultivar). On 28/5/2022, the experiment was applied according to the complete randomized block design (R.C.B.D.) as a factorial experiment with three replications, and statistical analysis of the data revealed and the following main results: There were significant differences among the average treatments in the effects of herbicides in all characteristics of the yield, except for the weight of 100 seeds.Weed free treatment was superior, followed by the Imazethapyr in terms of number of pods per plant, number of seeds perpods, seeds yield , biological yield, harvest index for which the weed-free treatment . There were significant differences among the averages of the treatments in the interaction between the factors of the study for all growth characteristic. The results also showed that there were significant differences in the percentage of oil and protein.
KEYWORDS: Soybean; Weeds; Herbicides; Spray Period.

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تأثير مكافحة الادغال في الحاصل ومكوناته الصفات النوعية لمحصول فول الصويا (*Glycine max* L.)

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الملخص
أجريت تجربة حقلية في إقليم كوردستان العراق للموسم الزراعي 2022-2023 في حقول محطة البحوث الزراعية في محافظة اربيل /عين كاوا لمعرفة تأثير مبيدات الأعشاب (imazethapyr وخليط bentazone + Gallant Super) وبالمعدل الموصى بها لكل من هذه المبيدات وفترات رش تلك المبيدات والتي شملت أربع فترات (أسبوعين، أربعة أسابيع، ستة أسابيع وثمانية أسابيع) بعد إنبات محصول فول الصويا صنف الشيماء). طبقت التجربة بتاريخ 2022/5/28 وفق تصميم القطاعات العشوائية الكاملة (R.C.B.D.) كتجربة عاملية بثلاثة مكررات، وتم تحليل البيانات إحصائياً والحصول على النتائج التالية: وجود فروقات معنوية بين متوسطات المعاملات في تأثير مبيدات الادغال في جميع صفات الحاصل ما عدا وزن 100 بذرة، ففي عدد القرنات بالنبات تفوقت المعاملة الخالية من الادغال يليها معاملة المبيد imazethapyr، وكذلك تفوقت المعاملة الخالية من الادغال في عدد البذور في القرنة، يليها مبيد الأعشاب imazethapyr. أما بالنسبة لحاصل الحبوب، فقد تفوقت أيضا المعاملة الخالية من الادغال، يليها مبيد الأعشاب imazethapyr وفي صفة الحاصل البيولوجي تفوقت المعاملة الخالية من الادغال تليها معاملة المبيد imazethapyr. اما دليل الحصاد فقد تفوقت المعاملة الخالية من الادغال. كما اظهرت النتائج بان هناك فروقات معنوية في صفتي النسبة المئوية للزيت والبروتين.
الكلمات المفتاحية: فول صويا، الادغال، المبيدات، فترة الرش.

INTRODUCTION

Soybean (Glycine max) is an annual legume grown in many parts of the world for its riche seeds in protein and oil. Soybeans alone represent more than 50% of the world's oilseed production (Imoloame, E.O. 2014). Soybean is one of the oldest legumes in the history of crop cultivation and

belongs to the family Fabaceae. It is famous as the golden bean and has become the miracle crop of the twenty-first century. It has been used for both purposes; namely oil seed production and agriculture to improve soil properties (Thakare *et al*. 2006). The soybean grains are largely used in the agroindustry, mainly in the production of plant oil, animal feed, chemical products and food. Currently, soybean is also an alternative for biofuels. In addition, the soybean crops are very valuable due to their high levels of produced proteins (Hungria, *et al*., 2013). It occupies an important position among the grain legumes due to its economic importance (Dugje *et al*., 2009). It is one of the excellent healthy foods because it contains (40-44%) of good quality protein, (20%) of cholesterol-free oil, (20%) of carbohydrates, and (0.69%) of phosphorous. 0.5^{-1}.5 tons of organic matter per hectare through defoliation (Kanase *et al*., 2006).

There are varieties of factors effect on reducing soybean yield, such as insect-pets and weeds. This research focuses on the impact of weeds on Soybean production. Weeds are considered a serious obstacle to the harvest of soybean crop and can reduce yield and economic returns. Reducing soybean yield due to weed infestation depending on weed type, soil and seasons and the severity of the spread of weeds, as some studies indicated that the highest decrease in yield reached 84% (Kuchroo *et al.,* 2003). Infection of soybean crop with weeds is, a continuous and complex restriction in many countries of the world, as it affects the growth of soybeans through Competition for nutrients, water and light (Vollmann *et al*., 2010). Therefore, weed control is a key factor for the success of soybean crop production, and weed management systems have been developed for this purpose (Buhler and Hartzler, 2004). The competition between yield and its weeds is the main obstacle of crop growth as known critical period, that the critical period for weed growth can be defined as the shortest critical period for crop growth in the presence of weeds with the high economic costs (Al-Mafrajy, 2015). Weed plants vary greatly depending on environmental and soil conditions, and in general weeds are found in greater numbers and with greater strength due to their ability to adapt on a larger scale, even under the most extreme levels of climatic, structural, and biotic stress (Jassim, 2022).

The Critical Period for Weed Control (CPWC) is an important principle of Integrated Weed Management (IWM), and is the period during which weeds must be controlled to prevent crop losses (Knezevic *et al* 2002). In general, the longer the period of coexistence between the crop and the weeds, the higher the damage to production. Another important point to be mentioned is probably the more significant influence that weed competition exerts on early-cycle varieties, where the period of coexistence and the time of coexistence can affect the yield potential of the crop (Chauhan and Mahajan, 2014). The Study aimed to the following: Knowing the effect of weed control on yield, yield components and qualities characteristics, Study the best period for controlling weeds, Knowing

the interaction between the factors of the study to determine the critical period for the control procedure.

MATERIALS AND METHODS

2.1. Description of the Study Area:

The experimental study was conducted during the summer season of the Kurdistan Region of the Iraq from 2022-2023 at Erbil Governorate of Agricultural Research/ Ainkawa at (Lat. 36014'51.0"N, long. 43059'50.5"E). Soil sample-s was analyzed for the physical and chemical properties by the Laboratories of the College of Agriculture / Hawija - Kirkuk University Directorate.

Some Physical and Chemical Prosperities of the Soil Location Study

Sample water	Ec dcm^{-1}	Ph	N pmm	P pmm	K pmm	O.M. %	Classification			
							Clay %	Silt %	Sand %	Texture
	2.63	7.3	84.4	4.6	1.33	1,1	355	436	209	Sand clay

2.2. Experimental Design

The experiment was designed according to the randomized complete block design as a factorial experiment with three replications and included two factors so that the number of treatments was sixteen (4 x 4 x 3 replicates) = 48 experimental units. and the last 20 cm. The experiment included two factors as follows:

2.2.1. First Factor: Two types of herbicides were used :

a. Imazethapyr 10% used in a quantity of 1250 cm3 / ha as a commercial effective substance to control broad and narrow- leaves weeds. (A1)
b. Tank mixture of the herbicide gallant Super + Bentazone. The mixture was used at a rate of 600 cm3 / ha. a.i + 1200 cm3 / ha, a.i. as the herbicide of Gallant super is used to control broad and narrow –leaves weeds, while the herbicide of Bentazone is used to control broad-leaved weeds. (A2)
c. weedy treatment: without any method control. (A3)
d. weed free: Weed control throughout the growing season so that it remains completely weed-free. (A4)

2.2.2. Second Factor: the spraying periods including the following:

a. 2 weeks after germination (B1).
b. 4 weeks after germination (B2)
c. 6 weeks after emergence (B3)

d. 8 weeks after germination (B4).

2.3. Agronomic Practice:

Different types of annual, Biennial and perennial weeds spread in the field with broad and narrow leaves.

Types of Weeds Spread in the Experimental Field

English name	scientific name	family	Life cycle
Large crab grass	*Digitaria sanguinalis* L.	Poaceae	perennial
Purple panic-grass	*Echinochloa colonum* L.	poaceae	Annual
Red root	*Portulaca oleracea* L.	Partulaceae	Annual
Amaranth	*Amaranthus reteroflexus* L.	Amaranthaceae	Annual
Black night shade	*Solanum nigrum* L.	Solanaceae	Annual
Gohnson grass	*Sorghum halepense* L.	Poaceae	perennial
Bermuda grass	*Cynodon dactylon* L.	Poaceae	perennial
Bur weed	*Xanthium strumarium* L.	Asteraceae	Annual
Leaved corton	*Chrozphera tinctoria* L.	Ephorbiaceae	Annual

2.4. Data Recording and study characteristics: the following characteristics were studied:

2.4.1. Yield and yield components characteristics :

2.4.1.1. Number of pods per plant

2.4.1.2.Number of seeds per pod

2.4.1.3.Weight of 100 seeds (g)

2.4.1.4.Seed yield (ton. ha^{-1}):

2.4.2. Qualitative characteristics:

2.4.2.1.Protein percentage: Protein percentage (%) = nitrogen percentage (%) x 6.25(Kalaf and Al-Rajbo, 2006).

2.4.2.2.Oil percentage: Oil percentage (%) = (oil weight / dry sample weight) x 100 (A.O.C.S.,1976).

RESULT AND DISCUSSION

3.1. Effect of Herbicides, Spray Periods and Interactions in Number of Pods per-Plant:

The results of the Table (3) show the effect of herbicides on the number of pods.$plant^{-1}$, as the treatment excelled free from weeds in control treatment , if it gave the highest average number of pods and reached (172.53), which did not differ significantly from the treatment with the Imazethapyr herbicide in quantity recommended, as the average number of pods was (159.38 plants) compared to the rest of the treatments, which indicates the high efficiency of this Imazethapyr herbicide (Basu T.K. and A.Sengupta ,2012)

While the effect of spraying periods on the number of pods. $plant^{-1}$, there were no significant differences between the mean treatments for all spraying periods. As for the effect of the interaction

between the factors of the study in the characteristic of the number of pods.plant^{-1}, the results of Table (3) showed that there were significant differences between the averages of the treatments if the treatment of Imazethapyr herbicide in the recommended quantity gave the highest average when used after two weeks of germination and reached (183.20), which did not differ significantly at the level of (5%) compared to the rest of the other spraying periods, and this is between the high efficiency of the herbicide on broad -leaved and narrow-leaved weeds in that perennial and annual period, as this period is distinguished for the weeds being in the stage (4-6) leaves of our approximation or at the beginning of its growth and its inability to compete with the crop, which follows the opportunity to obtain independence all requirements are in the stage of active vegetative growth .

Table 1. Effect of herbicides, spray periods and interactions of them in Numbers of pods per plant.

Treatment	Spray periods				Effect of Herbicide
	2 weeks	4 weeks	6 weeks	8 weeks	
Imazethapyr	183.20 a	172.93 ab	135.30 ab	146.10 ab	159.38 a
Haloxyfop-Methyl + Bentazon	127.97 b	122.90 b	125.43 b	148.03 ab	131.08 b
Control	113.75 b	123.79 b	115.74 b	120.80 b	118.52 b
Weed free	173.58 ab	171.48 ab	174.63 ab	170.43 ab	172.53 a
Effect of Period	149.62 a	147.78 a	137.77 a	146.34 a	

Different letters within column indicating of significant differences ($p<0.05$)

3.2. Effect of herbicides, spray periods and interactions of in Number of seeds per pod:

The results are placed in a Table (4) of the effect of herbicides in terms of the number of seed per pod as it showed that there were clear significant differences between the averages of the treatments, as the plants weed-free, in which the

control continued by all methods, gave the highest average number of seed per pod Its reached 3.12, and perhaps the reason is due to the weed not being allowed to continue depleting nutrients and other growth requirements, which affects this trait, which is considered a genetic trait and its optimal display is when removing the main reason for reducing it, which is the density of the weeds, and for this reason it appeared with this result, followed by the treatment of Imazethapyr and mixture of (Bentazone + Galant super), which did not differ significantly in the mean number of seeds. Its averages were (2.84 and 2.76) respectively, compared to the comparison treatment in which there was no weed control, if it gave the lowest average and reached (2.22) (Basu T.K. and A.Sengupta (2012). The effect of herbicides spraying periods, as the results of table (11) has showed that there were no significant differences between the averages of the treatments for four herbicide spraying periods. The results of the table show that there are significant differences in the averages of the treatments and the effect of the study factors on the number of seed per pod., where the weed-free treatment excelled during the spraying period 6 weeks after germination, as it gave the highest average number

of seed per pod, its reached to3.20 compared to the rest of the treatments, which did not differ significantly from the treatment of Imazethapyr when used in the period after 4 weeks of germination and reached 3.06, followed by the basin mixture of (Bentazone + Gallant super) and reached 2.83 when used after 8 weeks after germination. Perhaps the reason is due to the efficiency of these herbicides when used. In these periods, when it excelled when compared to the weed-free treatment, in which different methods were used in the control of weeds, which reduced the weed competition for the crop, and showed that superiority to the rest of the treatments, and this result is consistent with what he mentioned (El-Rokiek *et al.,* 2022).

Table 2. Effect of herbicides, spray periods and interactions of in number of seed per pod.

Treatment	Spray periods				Effect of Herbicide
	2 weeks	4 weeks	6 weeks	8 weeks	
Imazethapyr	2.76 cd	3.06 abc	2.76 cd	2.76 cd	2.84 b
Haloxyfop-Methyl + Bentazon	2.66 d	2.76 cd	2.80 cd	2.83 bcd	2.76 b
Control	2.22 e	2.24 e	2.23 e	2.20 e	2.22 c
Weed free	3.10 abc	3.16 ab	3.20 a	3.03 abc	3.12 a
Effect of Period	2.69 a	2.80 a	2.75 a	2.70 a	

Different letters within column indicating of significant differences ($p<0.05$)

3.3. Effect of Herbicides, Spray Periods and Interactions of in Weight of 100 Seeds (gm)

The results of the Table (5) showed the effect of herbicides on the weight of 100 seeds, as there were no significant differences between the averages of the treatments for this trait .

As for the effect of spraying periods, the results of the table showed that there were no significant differences between the averages of the treatments for all four periods, as the averages for the period ranged after 2 weeks, 4 weeks, 6 weeks and 8 weeks after germination 15.96 g, 16.07 g, 15.40 g, and 15.91 g respectively, grief in row. As for the effect of the interaction between the study factors, the results of the table showed that there were significant differences between the averages of the treatments, as the control treatment at the period after two weeks of germination gave the highest average weight of 100 seeds, which did not differ significantly from the treatment of Imazethapyr and the treatment of the mixture of (Bentazone + Haloxyfop-p-methyl) when used after 8 weeks after germination, as well as the use of the same herbicides for the periods 4 weeks and 6 weeks after germination, as well as did not differ from the weed-free treatment. The critical period for weed removal is called weeding (Basu T.K. and A.Sengupta , 2012).

Table 3. Effect of Herbicides, Spray Periods and Interactions of them on Weight of 100 Seeds.

Treatment	Spray periods				Effect of Herbicide
	2 weeks	4 weeks	6 weeks	8 weeks	
Imazethapyr	14.93 bc	15.84 abc	15.18 abc	16.77 ab	15.68 a
Haloxyfop-Methyl + Bentazon	15.30 abc	15.96 abc	15.69 abc	16.24 abc	15.80 a
Control	16.86 a	16.03 abc	14.70 c	14.89 bc	15.62 a
Weed free	16.76 ab	16.46 abc	16.02 abc	15.76 abc	16.25 a
Effect of Period	15.96 a	16.07 a	15.40 a	15.91 a	

Different letters within column indicating of significant differences ($p<0.05$)

3.4. Effect of Herbicides, Spray Periods and Interactions of them on Seed Yield (ton. ha^{-1}):

The grain yield represents the final outcome of the agricultural operations that lead to improving the yield in quantity and quality. The results of Table (6) showed the effect of the herbicide on the characteristic of the grain yield (ton.ha), while there were significant differences between the averages of the treatments, as the weed-free treatment gave the highest mean of 7.72. Ton.ha.$^{-1}$ Thus, it shows the extent of the effect of weeds on grain yield, measured by the comparison treatment or the use of herbicides, as they cannot be eliminated in a single way or by one-time control, as continuous control was used throughout the growing season, which reduced the load of specific competition (weed with crop), which was reflected On the proper growth of structures and full use of potential growth requirements with light, nutrients and water in an optimal manner, which increased the characteristics to the yield, which reflected positively on the total yield. This is consistent with what he mentioned (Patel *et al* , 2019). As for the effect of spraying periods, the results show Table (6) that there were no significant differences between those four periods .

As for the effect of the interaction between the factors of the study, the results of Table (6) showed that there are significant differences between the averages of the treatments and the effect of one factor on the other in the quality of grain yield, as the weed-free treatment outperformed the rest of the treatments, as it gave the highest average yield of 8.80 ton.ha^{-1} at a spraying period after (6) weeks of germination, and the reason may be due to the appropriate control in the early growth stages of the weeds, in which they have little competitive ability commensurate with the growth stage and thus led to an increase in the competitiveness of the crop, which increased the growth of the plant in its early stages, which was reflected on the characteristics of the yield and its components. This result is consistent with what was mentioned (El-Rokiek *et al* , 2022).

Table 4. Effect of Herbicides, Spray Periods and Interactions of them on Seed Yield (ton ha^{-1}).

Treatment	Spray periods				Effect of Herbicide
	2 weeks	4 weeks	6 weeks	8 weeks	
Imazethapyr	3.24 bcd	3.13 bcd	3.21 bcd	3.56 bc	3.28 b
Haloxyfop-Methyl + Bentazon	3.93 b	2.77 cd	2.85 bcd	2.89 bcd	3.11 b
Control	2.26 d	2.40 d	2.43 d	2.19 d	2.32 c
Weed free	8.08 a	7.80 a	7.52 a	7.48 a	7.72 a
Effect of Period	4.37 a	4.03 a	4.00 a	4.03 a	

Different letters within column indicating of significant differences ($p<0.05$)

3.5. Effect of Herbicides, Spray Periods and their Interactions of on Protein Percentage (%)

The characteristic of the protein percentage is one of the specific characteristics of the soybean crop, and it can be considered as one of the genetic characteristics of the group of legume crops, so it is not affected much by herbicides, as the results of the Table (7) show that there are significant differences between the averages of the treatments, as the comparison treatment gave the highest average protein percentage, which reached (27.67 %), which did not differ significantly from the treatment of Imazethapyr, as it gave an average of (26.75%) compared to other treatments, and this indicates that it is a genetic characteristic of these crops (legumes), as well as one of the specific characteristics, as we mentioned, and is not affected by the herbicide, but rather by competition that affects growth as a result of lack of efficiency of representation photosynthesis in which protein is one of the products of this process, and this result is consistent with(Hosmath , 2014) . As for the effect of periods on this trait, the results of the Table (7) showed that there were significant differences between the averages of the treatments at the level of (5%), as the spraying period after two weeks of germination gave the highest average and reached (25.88%), which did not differ significantly from the spraying treatment after 6 week from germination, and the reason may be due to spraying after two weeks, which is the critical period for removing weeds and reducing competition with the crop, which provides an opportunity for the plant to benefit from the growth requirements and thus reflects positively on the efficiency of photosynthesis, which made a difference in it (Shaban, *et al* ,1991). As for the effect of the interaction between the factors of the study, the results of the Table (7) showed that there were significant differences between the averages of the treatments, as the Imazethapyr treatment excelled when used after 6 weeks of germination, and the average protein percentage reached (8.55%), which confirms that the optimal use of the herbicide is at an early stage rom growth, competition is as low as possible, which provides an opportunity to take advantage of the growth requirements and increase the efficiency of photosynthesis and its reflection on the percentage of protein in the seeds.

Table 5. Effect of Herbicides, Spray Periods and Interactions of in Percentage of Protein Trait (%).

Treatment	Spray periods				Effect of Herbicide
	2 weeks	4 weeks	6 weeks	8 weeks	
Imazethapyr	26.47 a-e	26.76 a-e	28.55 a	25.20 a-e	26.75 a
Haloxyfop-Methyl + Bentazon	25.66 a-e	16.30 f	23.68 be	6.91 g	18.14 c
Control	28.37 ab	27.13 a-d	27.70 a-c	27.50 a-c	27.67 a
Weed free	23.03 c-e	22.60 de	22.13 e	23.43 c-e	22.80 b
Effect of Period	25.88 a	23.20 b	25.51 a	20.76 c	

Different letters within column indicating of significant differences ($p<0.05$)

3.6. Effect of Herbicides, Spray Periods and their Interactions of on Oil Percentage (%)

The Percentage of oil is one of the important qualitative characteristics of the soybean crop, and the Plant may be bred in order to improve this characteristic, as well as paying attention to other agricultural operations for the purpose of maintaining or increasing this characteristic within the variety, So the results of the Table (8) on the effect of herbicides are shown the weed in the characteristic of percentage of oil in soybean seeds showed that there were significant differences between the averages of the treatments, as the treatment of (Bentazone + Haloxyfop-p-methyl) excelled and gave an average oil percentage of (62.00%) compared to the other treatments, followed by the treatment without weeds, the reason may be due to the efficiency of the herbicides used in those treatments, in addition, this characteristic is one of the trait more clearly, and this result is consistent with what was mentioned by (Hosmath , 2014) . As for the effect of spraying periods, the results of the table showed that there were no significant differences between the average of the treatments for all four spraying Periods .

As for the effect of the interaction between the factors of the study in the characteristic of Percentage of oil in soybean seeds, the results of the table showed that there were significant differences between the averages of the treatments, as the treatment of the mixture of (Bentazone + Haloxyfop-p-methyl) herbicides excelled when using that mixture after four weeks of germination and gave the highest average percentage of oil and reached (69.3%) which did not differ significantly from the other two periods, after six weeks and eight weeks, with the same mixture, and gave (65.4% and 65.2%) respectively, and also did not differ significantly from the treatment in which the Imazethapyr herbicide was used after two weeks of germination and gave an average of percentage of (65.2%), and the reason may be due to the high efficacy of these herbicides on weeds (table number of weed and Percentage of control) and the time period for conducting such control based on the growth of weeds and its low competitiveness in that period, which reflected positively on growth and specific characteristic, including the percentage of oil, and this result agree with what everyone wrote (RK Raj *et al*., 2020).

Table 6. Effect of Herbicides, Spray Periods and Interaction of in Oil Percentage (%).

Treatment	Spray periods				Effect of Herbicide
	2 weeks	4 weeks	6 weeks	8 weeks	
Imazethapyr	65.2 a	30.8 b	31.2 b	58.8 ab	46.5 b
Haloxyfop-Methyl + Bentazon	48.1 ab	69.3 a	65.4 a	65.2 a	62.0 a
Control	44.7 ab	53.4 ab	52.5 ab	51.7 ab	50.6 ab
Weed free	54.7 ab	53.0 ab	53.4 ab	52.7 ab	53.5 ab
Effect of Period	53.2 a	51.6 a	50.6 a	57.1 a	

Different letters within column indicating of significant differences ($p<0.05$)

CONCLUSION

the use of the mixture of Bentazone + Gallant Super pesticides was highly effective on various harmful weeds, the herbicide Imazethapyr were effective on all types of weeds during critical spraying periods, spraying herbicides in the periods of four and six weeks after germination were the most effective on harmful weeds, which can be called the critical period for control, the interaction of study factors were significant when using both types of herbicides within the period of competitive activity of weeds, which can be limited to between four and six weeks after germination.

REFERENCES

A.O.A.C. (1980) Official Methods of Analysis of 13th Edition Association of Official Analytical Chemists Washington, D.C. USA.

A.O.C.S. (1976). Official and Tentative Methods of American oil Chemists Society Cruds Fat Aa 6-38, The Society – Champaign 11, USA.

Ajokporise D., F.O.Ogedegbe and S.E.Nwangie (2018). Effect of weed Management Methods on Growth and Yield of Soybean (Glycin max L. Merr) in the Wet Rin-Forest Zone of Nigeria. International Journal of Innovative Agriculture &Biology Research 6(1):18-23.

Al-Mafrajy, Abdulmueen S. H, (2015). Efficiecy of herbicide mixture Application Topik and Granestar in Weed Control for Wheat Crop (Triticum aestivum L.). Ph. D. Thesis, College of Agriculture-University of Mosul.

Basu T.K. and A.Sengupta (2012).Efficacy of new herbicide molecule Imazethapyr on weed control in soybean . Journal of Crop and Weed 8(1):137^{-1}40 .

Buhler D.D., Hartzler R.G. (2004) Weed biology and management. In: Boerma, H.R., Specht, J.E. (Eds.), Soybeans: Improvement, Production and Uses. 3rd ed., Series Agronomy, No. 16. American Society of Agronomy, Madison, WI, pp. 883–918.

Chauhan, B.S. and Mahajan, G. (2014) Integrated weed management in soybean. In Recent Advances in Weed Management; Springer: New York, NY, USA, 2014; pp. 223–237.

Datta, A.; Ullah, H.; Tursun, N.; Pornprom, T.; Knezevic, S.Z.; Chauhan, B.S. (2017) Managing weeds using crop competition in soybean [Glycine max (L.) Merr.]. Crop Prot. 2017, 95, 60–68.

Dugje, I. Y., Omoigui, L. O., Ekeleme, F., Bandyopadhyay, R., Kumar, P. L., Kamara, A. Y. (2009). Farmers Guide to Soybean Production in Northern Nigeria. International Institute of Tropical Agriculture,

Ibadan, Nigeria. 21 pp. http://dx.doi.org/10.1007/s00705-010-0630-3.

El-Rokiek K.G., S. A. Saad El-din, M. G. Dawood , and M. E. El-awadi (2022). Effect of the herbicide Bentazone in combination with trehalose on wheat, growth, yield and associated broad weed Anagalis arvensis . J. Mater. Environ. Sci. ,2022, Volume 13, Issue 08, Page 979-987.

El-Sahookie, M. M. (1991). Soybean production and improvement. Ministry of Higher Education and Scientific Research - Iraq - University of Baghdad. PP. 360.

Gaur, P. M., Jukanti, A. K., Samineni, S. Chaturvedi, S. K., Singh, S., Tripathi, S., Singh, I., Singh, g., Das, T.K., and Aski, M.J.A. (2013). Large genetic Variability in chickpea for tolerance to herbicides Imazethapyr and Metribuzin. 3, 524-536 .

Hosmath J.A. (2014) Bioefficacy of quizalofop-p-teruryl 4.41 EC against weeds in soybean ecosystems in India. In: Proceedings of SOYCON-2014. International Soybean Research Conference on Mitigating Productivity Constraints in Soybean for Sustainable Agriculture, 22- 24 Feb., 2014 held at Directorate of Soybean Research, Indore, 2014, 194.

Hungria, M.; Nogueira, M.A. & Araujo, R.S. (2013). Co-inoculation of soybeans and common beans with rhizobia and azospirilla: strategies to improve sustainability. Biol fert soils, 49(7), 791-801.

Imoloame, E.O. (2014). The effect of different weed control methods on weed infestation growth and yield of soybean (Glycine max) in Southern Guinea Savannah of Nigeria. Global Journal of Science Frontier Research, 13(6); 20-33.

Jassim, A.H.A. (2022) Effect of plant density and combinations of herbicide on companions weed, growth, yield and components of corn crop (Zea mays L.) . Master Thesis, College of Agriculture –University of Kirkuk.

Kachroo, D., A. K. Dixit and A. S. Bali (2003). Weed management in oilseed crops- A Review. Shair A Kashmir University of Agricultural Science and Technology Journal of Research, 2(1): $1^{-1}2$.

Kalaf, A. S., and Al-Rajbo, A. A. (2006). Seed technology. Ministry of Higher Education and Scientific Research. Mosul University.pp.891.

Kanase AA, Mendhe S.N., Khawale V.S, Jarande N.N., Mendhe JT (2006). Effect of integrated nutrient management and weed biomass addition on growth and yield of soybean. J. Soils Crops. 16(1):236-239.

Knezevic, S. Z, Evans, S, & Blankenship, E. E. Acker RCV, Lindquist JL. (2002). Critical peri- od for weed control: the concept and data analysis. Weed Science. 1550-2759, 50, 773-786.

Patel A., N. Spare, G. Malgaya and Dharmendra (2019). Effect of post Emergence Herbicides on Growth and Yield of Soybean. Journal of plant Development Sciences Vol. 11(2): 89-92 .

Place, G.T.; Reberg-Horton, S.C.; Dickey, D.A.; Carter, T.E., Jr. (2011) Identifying soybean traits of interest for weed competition. Crop Sci. 2011, 51, 2642–2654.

RK Raj, KK Sinha, Shalu Kumari, Anup Kumar Choubey, Ashok Pandit and Dinesh Kumar Yadav (2020). Effect of nutrient and weed management on yield, nutrient uptake and quality of soybean [Glycine max (L.) Merrill] in alluvial soil of Bihar. Journal of Pharmacognosy and Phytochemistry 2020; 9(2): $1586^{-1}58$.

Shaban, A. Sh.; A.A. Metwally; N.I. Ashour and E.M. Abd El-Lattef (1991). Studies on selected herbicidal combinations in intercropping maize and soybeans. 11- growth and chemical analysis. Egypt. J. Agron., Special Issue, PP. 47-59.

Thakare, K.G., Chore CN, Deotale RD, Kamble PS, Sujata BP, Shradha RL (2006). Influence of nutrients and hormones on biochemical and yield and yield contributing parameters of soybean. J. Soils Crops

16(1):210-216.

Vollmann, J., Wagentristl, H. and Hartl, W. (2010). The effects of simulated weed pressure on early maturing Soybean. European Journal of Agronomy, 32: 24348.