MIKAILALSYS
Journal of Multidisciplinary Sciences

e-ISSN : 2987-2286
p-ISSN : 2987-3924

Index : Dimensions, Scilit, Crossref, Garuda, Semantic, Lens,Google Scholar,Base, etc

https://doi.org/10.58578/mikailalsys.v3i3.7945

Effect of Rates of Herbicide (Butachlor) on Weeds and Yield of Sunflower in Wukari Local Government Area in Taraba State, Nigeria

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Article Info:

Submitted:	Revised:	Accepted:	Published:
Nov 10, 2025	Dec 1, 2025	Dec 13, 2025	Dec 18, 2025

Abstract

Weeds are a major cause of yield and quality loss in sunflower (*Helianthus annuus* L.) production, making effective weed management essential. This study aimed to evaluate the effects of different butachlor-based weed-control regimes on weed suppression and grain yield of three sunflower varieties (Samsun1, Samsun3, and Local) at the Teaching and Research Farm of Federal University Wukari, Taraba State, Nigeria, during the rainy season. The experiment was laid out in a randomized complete block design with three replications, combining the three sunflower varieties with weed-management treatments that included butachlor applied at different rates, hoe weeding at 3, 6, and 9 weeks after sowing (WAS), and a weedy check. The results showed that butachlor at 1.5 kg a.i./ha, supplemented with hoe weeding at 6 and 9 WAS, produced significantly lower weed infestation, higher weed-control efficiency, and the highest grain yield per plot, with Samsun1 outperforming Samsun3 and the Local variety under this regime. This treatment was followed in effectiveness by butachlor at 1.0 kg a.i./ha and by sole hoe weeding at 3, 6, and 9 WAS, whereas the weedy check recorded the lowest grain weight per

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plot and the highest weed cover. The study concludes that integrating butachlor at 1.5 kg a.i./ha with supplementary hoe weeding at critical growth stages offers an effective strategy for reducing weed pressure and improving sunflower grain yield under the conditions of Wukari, thereby providing practical guidance for weed-management decisions in similar agro-ecological environments.

Keywords: Sunflower (*Helianthus annuus* L.); Butachlor; Weed Control; Grain Yield; Variety Response

INTRODUCTION

Since the time of emergence of both weeds and crops, which period is very important in their competitive relationships, it is noticed that sunflower is not always such a good competitor because of its slow growth in the initial stage. Regardless of the fact that sunflower has large leaves and a good canopy formation, weeds always have the advantage at the outset due to sunflower's slow initial growth. It is especially important to pay attention to the dominant weed species, considering that different species within one community differently affect the growth and yield of sunflower. A. artemisiifolia, X. strumarium, D. stramonium, A. retroflexus, and other undesirable weeds are typically already present when sunflowers, which are thermophile plants, are planted in the middle of spring. In terms of nutrients, soil moisture, light, and space, weeds compete with crop plants. It has been predicted that weeds can reduce sunflower yields by up to 81% (Smatana et al., 2014). Therefore, timely weed control is essential for optimizing sunflower yields. Having information on the time of weed emergence in relation to crop emergence is an important factor in making decisions on weed control (Özki et al., 2021).

The sunflower (*Helianthus annuus L.*) is a member of the Asteraceae family. 14 of the 65 species in the Helianthus genus are annual plants (Fernández-Luqueño et al., 2014). Eastern North America is where the sunflower plant first appeared. Native Americans are believed to have domesticated it circa 3000 B.C. When the sunflower was brought to the Russian Federation in the late 1800s, it quickly gained popularity as a food crop, and Russian farmers greatly improved the cultivation methods. Sunflower has been used for a variety of purposes since 3000 B.C., including as an attractive plant, medicine, food, fuel, fodder, textile colours, body paint, decorations, and more.

Sunflower species are allopathic in nature and this crop appears to have a bright future, especially if the scientists can translate the cutting-edge research into technologies that will reduce the reliance on synthetic herbicides, pesticides, and crop protection chemicals (NSA, 2013). Sunflower is well known by its phytoremediation potential, thus it can be speculated that the good tolerance of sunflower towards pollutants coupled with an increased accumulation/degradation capacity might contribute to an efficient removal of pollutants from soil and water. It also possesses the potential to develop bioenergy systems that allow for synergies between food and energy production (Prasad, 2024). Because the sunflower has several potential markets, it is a good choice for growers on both small and large scales. However, it has to be remembered that scientific, technical or agricultural projects linked with sunflower have to include side effects elsewhere in order to shape a sustainable future. Phytoremediation consists of mitigating pollutant concentrations in contaminated soils, water, or air, with plants able to contain, degrade, or eliminate contaminants and its derivatives. H. annuus is a plant with not only food and energy values, but also with phytoremediation potential (Nikolić & Stevović, 2015). It is one of the most widely studied plants for heavy metal phytoremediation (Kara et al., 2013). However, it is well known that sunflower is able to contain, degrade or eliminate metals from soil or water. Investigations with H. annuus have revealed that several heavy metals, including lead, cadmium, copper, zinc and cobalt, accumulate at high concentrations in shoots as well as in roots. Heavy metal uptake is minor in seeds than in roots and shoots

The level of weed infestation of sunflower (*Helianthus annuus L.*) differs over locations and directly affects the intensity of the competitive relationships between crops and weeds, which results in lower or greater yield losses Since the time of emergence of both weeds and crops, which period is very important in their competitive relationships, it is noticed that sunflower is not always such a good competitor because of its slow growth in the initial stage (Villamil-Mahecha et al., 2025). Although the relative importance of soil-applied herbicides in sunflower production has declined with the introduction of effective post-emergence herbicides and the development of herbicide-resistant cultivars, these products are still in use because of their reliable price and effective weed control. One of the most important limiting factors affecting the development of the sunflower crop is weeds. Numerous studies have found that the parasitic weed broomrape (Orobanche cumana Wallr.), together with a variety of grass and broad-leaved weeds, considerably lower this crop's seed output. Cultural methods (e.g., intercropping, mulching, and

competitive cultivars) and the application of different pre- and post-emergence herbicides are used to manage weeds in this broadleaved crop. Through the use of herbicides that block the enzyme acetolactate synthase, such as imazamox and tribenuron-methyl, the creation of sunflower hybrids resistant to imidazolinones (Clearfield® technology) and sulfonylureas (ExpressSun® technology) has greatly aided in the control of weeds in this crop (Karkanis et al., 2022).

Experiments have been carried out to improve the growth and development of sunflower under natural or stress conditions (Gerardo et al., 2013; Nasim et al., 2011; Da Silva et al., 2012). Naz and Bano (2013) reported that the adverse effects of salt stress on sunflower growth could be alleviated by foliar application of salicylic acid alone or in combination with Azospirillum and Pseudomonas inoculations. Gholamhoseini et al. (2013) shown that the application of Glomus musseae and Glomus hoi could be critical in the cultivation of sunflowers under arid and semi-arid conditions, where water is the most important factor in determining plant growth and yield. Additionally, Akbari et al. (2011) reported that inoculating the sunflower seeds with plant-growth promoting rhizobacteria increased. Sunflower has several potential markets; it is a good choice for growers on both small and large scales. Sunflower species are allopathic in nature and this crop appears to have a bright future, especially if the scientists can translate the cutting-edge research into technologies that will reduce the reliance on synthetic herbicides, pesticides, and crop protection chemicals. Hence, the aim of the study is to investigate the effect of different rates of herbicide (butachlor) on weeds and yield of sunflower and select the best rate of herbicide for control of weeds in sunflower.

METHODOLOGY

Site Description

The experiment was carried out at the Teaching and Research farm of Federal University Wukari, Taraba State Nigeria during the rainy season. Wukari is within the southern Guinea Savannah zone of Nigeria (latitude 7.85°No and longitude 9.78° at 152m above sea level) with annual rainfall of 1450mm and average relative humidity of 78%. It has the total population of 12, 415, 46 people according to the 2016 census. It has a land area of 4308km^3

Treatment and Experimental Design

The trial consists of three varieties of sunflower; Samsun1, Samsun 3, and Local and rates at 2kg/h, 3kg/h, hoe weeding at 3 and 6 weeks after sowing (WAS), and weedy check or control laid out in a Randomize complete block design (RCBD). The treatments were replicated 3times.

Varietal Description

The three (3) varieties of sunflower; Samsun1, Samsun 3 were obtained from Samaru Kaduna State and Local were obtained from Wukari Taraba State. Samsun1 yields about 2.21 t/ha with an early maturing (80 days) with medium Seed size and light ash colour. It has plant height of 120 cm, drought tolerant with Vitamin A and a very good anti-oxidant. Samsun3 yield about 2.7 t/ha with a late maturity period of 92 days and a cream seed colour. It has plant height of about 122 cm, good seed quality, and very good anti-oxidant. Local variety yield about 2.0 tones/ha with late maturing period of about 120 days with black seed colour. It has a plant height of about 190 to 200cm average seed quality and drought tolerant.

Cultural Practices

Land preparation

The Field was ploughed and harrowed trice to get a fine tilt after which the field was ridged at 75cm between rows, mapping out of land using measuring tape, pegs and twines was carried out to maintain accuracy of plots and walk ways. 200mls of paracot was diluted in 10 liters of water and sprayed on the experimental plots one week. The gross plot and the net plot are $9m^2$ and $4.5m^2$ respectively. Each plot had four rows with 48 stands of sunflower per plot respectively. Sowing of the sunflower seeds was done using the dibbling method. The spacing is 75cm between the rows and 25cm within the rows respectively. Three seed were sown and later thinned to one plant per stand at two weeks after sowing (2WAS) to ensure that only the weak ones are those to be eliminated during thinning operation. Sunflower maturity takes place at about 3 - 4 months after planting depending on cultivars and environment. During seed ripening, dry warm weather is necessary. Strong winds can cause the crop to lodge which can cause considerable losses in yield.

Crop protection and Weed control

40mls of cypermetrine insecticide was diluted in 20litrs of water and sprayed to control insect pests. The weeds were controlled using different rates of herbicide; as per the treatment enumerated.

Fertilizer application

Fertilizer was applied in two split doses at 2WAS to supply 60Kg N, 30Kg P, and 30Kg K. The second application was done at 6WAS using Urea (46%N) to supply the remaining Nitrogen. Fertilizer recommendation of sunflower is NPK 60:30:30.

Harvesting and Dryings

Most varieties of sunflower shatter readily, so timely harvesting is essential. This must be done at physiological maturity (even the back of the head turns yellow and the bracts become brown). This prevents shattering and bird damage and also encouraged rapid drying. The flower heads are cut off and sun dried in stalks or inverted on individual spikes. Harvesting were done manually by cutting the head and sundried to a constant weight. Rates on growth and yield parameters were taken at 3wweks intervals. The number of stand per plot were counted and recorded at 2WAS and at harvest. The Crop vigor score was assessed in each plot at 3, 6,9,12 WAS and at harvest using physical observation. A scale of 1-10 was used, where 1 was assigned to completely destroyed plant and 10 to most healthy plant. The assessment features of the plant used for scoring are plant height, vegetative aspect (colour) of the plant and the girth.

Plant Height (cm)

The height of five randomly tagged plants in each plot were measured from the base of each plants to the highest growing point at 3, 6, 9, WAS and at harvest using meter rule. The average height was recorded.

Weed count and Stem girth

A $1m^2$ quadrant was use to randomly encompass weed in the plots and the number of grasses, broadleaved weeds, sedges and other weeds were separated and counted at 3, 6, 9, 12 WAS and at harvest. The girth of the five randomly selected plants was measured with a veneer caliper and average was recorded.

Yield and Yield Components

The numbers of heads were counted per plots and recorded. The grain weight per net plot was measured using a sensitive measuring scale and was recorded. Each net plot was harvested, shelled winnowed, The 100 seeds of the net plot was counted and was weighed using a sensitive weighing scale and was recorded. Each net plot was harvested, shelled winnowed and the yield was expressed in kg/ha. The weight of the grain per net plot was measured using a sensitive measuring scale and was recorded.

Data Analysis

The data collected were subjected to analysis of variance for split plot design to test the significance of treatment means. Means were separated using Duncan Multiple Range Test Duncan (1955).

RESULTS AND DISCUSSION

Table 1 show the effect of Variety and herbicide on stand count. Variety and Herbicide did not have significant effect on stand count of sunflower at all the sampling stage. Table 2 show the effect of Variety and herbicide on plant height of sunflower at 3, 6, 9WAS and at Harvest. Variety and herbicide did not have significant effect on plant height at all the sampling stages.

Table 1. The Effects of Varieties and Herbicide on Stand Count in Wet Season

Treatment	2WAS	HVST
Variety		
Samsun1	20.75	17.50
Samsun 3	20.25	18.67
Local	22.00	18.33
S.E±	0.79	0.45
Herbicide Rates Butachlor 1kgai/ha		
	21.33	19.00
Butachlor 1.5kgai/ha	20.44	17.44
Hoe weeding	20.56	18.56
Weedycheck	21.67	17.67
S.E±	0.92	0.52

Means followed by the same letter(s) with an column and treatment group are not significantly different at $P < 0.05$. Using Duncan's New multiple Range Test(DMRT). WAS = weeks after sowing.

Table 2. The Effects of Varieties and Herbicide on Plant height in Wet Season

Treatment	3WAS	6WAS	9WAS	HVST
Variety				
Samsun1	14.8	123.05	171.83	150.15
Samsun 3	14.68	111.50	168.75	164.85
Local	14.42	121.06	176.32	175.02
S.E±	0.88	7.22	11.07	8.29
Herbicide Rates				
Butachlor 1kgai/ha	15.09	112.44	171.22	158.22
Butachlor 1.5kgai/ha	14.36	118.29	172.82	162.64
Hoe Weeding	14.78	113.87	162.20	166.78
Weedy Check	14.29	129.56	183.02	165.71
S.E±	1.02	8.34	9.58	9.57

Means followed by the same letter(s) with a column and treatment group are not significantly different at $P < 0.05$. Using Duncan's New multiple Range Test (DMRT). WAS = weeks after sowing.

Table 3 shows the effect of Variety and herbicide on grass count. Variety a did not have significant effect on grass count at all the sampling stages except at 9WAS where Local variety gave the highest number of grasses followed by Samsun1 and 3 which were comparable herbicide had significant effect on number of grasses at all sampling stages except at 6WAS. At 3WAS 1.0kg of butachlor gave higher number of grasses followed by all the other treatments which were comparable at 9WAS, weedy check gave significantly higher number of grasses while all the other treatment were comparable. At harvest weedy check gave the highest number of weeds while butachlor at 1.5kg gave the lowest number of grasses but was comparable to hoe weeding which was in turn comparable to butachlor at 1.5kg. Table 4 shows the effect of varieties and herbicides on number of broad leave count s. Varieties and herbicides1 gave significant effect on broad leave count at all the sampling stages. At all the sampling stages, local variety of sunflower supported higher number of broad leaves than all others which were comparable. At 3WAS weedycheck and butachlor at 1.0kg gave the highest number of broad leave followed by 1.5kgai/ha. Hoe weeding gave the lowest number of broad leaves. At 6 WAS butachlor 1kgai/ha, butachlor at 1.5kgai/ha and weedy check gave the highest number of broad leaves. Hoe weeding gave

the lowest number of broad leaves. At 9 WAS, weedy check gave the highest number of broad leave followed by hoe weeding. Butachlor at 1.kgai/ha and 1.5kgai/ha gave the lowest and comparable number of broad leaves. At harvest, weedy check gave the highest number of broad leaves followed by butachlor 1kgai/ha 1,5kgai/ha and hoe weeding gave lowest but comparable numbers of broad leaves.

Table 3. The Effect of Varieties and Herbicide on Grass Count during the wet season

Treatment	3WAS	6WAS	9WAS	HVST
Variety				
Samsun1	2.167	6.917	4.583^{b}	8.667
Samsun 3	1.333	6.833	4.000^{b}	7.083
Local	1.500	6.833	7.083^{a}	7.750
S.E±	0.49	0.77	1.22	0.68
Herbicide Rate				
Butachlor 1kgai/ha	2.778^{a}	6.778	3.111^{b}	2.222^{c}
Butachlor 1.5kgai/ha	1.778^{b}	7.222	1.556^{b}	6.444^{b}
Hoe weeding	1.444^{b}	6.444	4.111^{b}	4.889^{bc}
Weedycheck	0.667^{b}	7.000	12.111^{a}	17.778^{a}
S.E±	0.56	0.89	1.41	0.79

Means followed by the same letter(s) with a column and treatment group are not significantly different at $P < 0.05$. Using Duncan's New multiple Range Test (DMRT). WAS = weeks after sowing.

Table 4. The Effects of Varieties and Herbicide on Broad leaves Count in the Wet Season

Treatment	3WAS	6WAS	9WAS	HVST
Variety				
Samsun1	12..917^{b}	18.000^{b}	1.021^{b}	14.083^{b}
Samsun 3	11.833^{b}	18.167^{b}	9.000^{b}	14.750^{b}
Local	15.167^{a}	19.167^{a}	13.417^{a}	18.500^{a}
S.E±	1.19	1.02	2.19	2.99
Herbicide Rate				
Butachlor 1kgai/ha	16.556^{a}	21.000^{a}	3.778^{c}	9.222^{b}
Butachlor 1.5kgai/ha	12.111^{b}	19.111^{a}	2.556^{c}	8.889^{b}
Hoe weeding	8.667^{c}	12.889^{b}	9.556^{b}	8.556^{b}
Weedycheck	15.889^{a}	20.778^{a}	18.111^{a}	13.444^{a}

Treatment	3WAS	6WAS	9WAS	HVST
S.E±	1.37	1.18	2.53	2.69

Means followed by the same letter(s) with a column and treatment group are not significantly different at $P < 0.05$. Using Duncan's New multiple Range Test (DMRT). WAS = weeks after sowing.

Table 5 shows the effect of variety and herbicides on number of sedges were significant at 3 WAS and at harvest and herbicide was significant at all the sampling stages. At 3 WAS, Samsun3 variety of sunflower supported higher number of sedges while Samsun1 and local variety gave lower but comparable number of sedges. Butachlor 1kgai/ha, 1.5kgai/ha and weedy check gave the highest number of sedges. Hoe weeding gave the lowest number of sedges. At 6WAS, variety had no significant difference on number of sedges. Butachlor 1kgai/ha and 1.5kgai/ha gave the highest number of sedges. While hoe weeding and weedy check gave the lowest but comparable number of sedges. At 9WAS, varieties of sunflowers had no significant difference on number of sedges. Weedy check gave the highest number of sedges, butachlor 1.5kgai/ha followed by hoe weeding but was comparable to butachlor 1.5kgai/ha which was in turn comparable to 1kgai/ha, butachlor at 1.0kg which gave the lowest number of sedges.

At harvest Samsun 3 variety of sunflower supported higher number of sedges, followed by local variety. Samsun1 gave the lowest number of sedges. Weedy check gave the highest number of sedges while all the other treatments gave the lowest but comparable number of sedges.

Table 6 shows the Effects of Varieties and Herbicide on numbers of leaves, varieties and herbicide only at 6 WAS. At 6 WAS varieties Samsun1 and local gave higher and comparable of leaves while Samsun3 gave the lowest number of leaves. Hoe weeding gave the lowest number of leaves followed by butachlor at 1.5kgai/ha, weedycheck and butacholr at 1.0kgai/ha gave the lowest and comparable number of leaves.

Table 5. The Effects of Varieties and Herbicide Sedges Count in Wet Season

Treatment	3WAS	6WAS	9WAS	HVST
Variety				
Samsun1	2.250[b]	3.167	2.337	1.417[c]
Samsun 3	4.250[a]	3.250	2.750	2.083[a]
Local	2.833[b]	3.417	2.583	1.833[b]
S.E±	0.72	0.35	0.22	0.17
Herbicide Rate				
Butachlor 1kgai/ha	4.222[a]	4.111[a]	1.889[c]	1.511[b]
Butachlor 1.5kgai/ha	3.556[a]	4.111[a]	2.000[bc]	1.221[b]
Hoe weeding	1.333[b]	2.556[b]	2.444[b]	1.561[b]
Weedycheck	2.667[a]	2.667[b]	2.222[a]	1.991[a]
S.E±	0.84	0.41	0.26	0.20

Means followed by the same letter(s) with an column and treatment group are not significantly different at **P** < 0.05. Using Duncan's New multiple Range Test (DMRT). WAS = weeks after sowing.

Table 6: The Effects of Varieties and Herbicide on numbers of leaves in Wet Season

Treatment	3WAS	6WAS	9WAS
Variety			
Samsun1	11.267	21.067[a]	20.975
Samsun 3	11.433	19.783[b]	21.183
Local	11.617	21.500[a]	20.250
S.E±	0.19	0.54	0.49
Herbicide Rate			
Butachlor 1kgai/ha	11.422	19.889[c]	21.711
Butachlor 1.5kgai/ha	11.422	20.956[b]	20.589
Hoe weeding	11.444	22.689[a]	20.200
Weedycheck	11.467	19.600[c]	20.111
S.E±	0.17	0.63	0.56

Means followed by the same letter(s) with a column and treatment group are not significantly different at P < 0.05. Using Duncan's New multiple Range Test (DMRT). WAS = weeks after sowing.

Table 7 shows the Effect of Varieties and Herbicide on stem girth of sunflower. Varieties and herbicide rate had no significant effect on stem growth across all sampling

stages. Table 8 show the effect of varieties and herbicides on crop vigor score of sunflower. Varieties of sunflower did not have significant effect on sunflower at all the sampling state, except on herbicide at 6WAS and 9WAS. At 6 and 9WAS, butachlor 1kgai/ha, 1.5kgai/ha and hoe weeding gave the highest crop vigor score. Weedy check gave the lowest crop vigor score.

Table 7: The Effect of Varieties and Herbicide on stem girth in 2021 Wet Season

Treatment	3WAS	6WAS	9WAS
Variety			
Samsun1	0.60	0.26	0.37
Samsun 3	0.65	0.19	0.36
Local	0.62	0.22	0.35
S.E±	0.03	0.04	0.02
Herbicide Rate			
Butachlor 1kgai/ha	0.59	0.19	0.34
Butachlor 1.5kgai/ha	0.63	0.21	0.35
Hoe weeding	0.63	0.21	0.39
Weedycheck	0.63	0.29	0.35
S.E±	0.04	0.04	0.02

Means followed by the same letter(s) within a column and treatment group are not significantly different at **P** < 0.05. Using Duncan's New multiple Range Test(DMRT). WAS = weeks after sowing.

Table 8: The Effects of Varieties and Herbicide on crop vigor score in Wet Season.

Treatment	3WAS	6WAS	9WAS
Variety			
Samsun1	6.667	7.750	8.583
Samsun 3	5.083	7.750	8.083
Local	6.583	7.833	6.500
S.E±	0.81	0.15	0.21
Herbicide Rate			
Butachlor 1kgai/ha	5.444	8.667[a]	8.778[a]
Butachlor 1.5kgai/ha	6.222	8.667[a]	8.889[a]
Hoe weeding	6.111	8.788[a]	8.111[a]
Weedycheck	6.667	5.000[b]	5.111[b]
S.E±	0.93	0.18	0.24

Means followed by the same letter(s) within a column and treatment group are not significantly different at **P** < 0.05. Using Duncan's New multiple Range Test (DMRD). WAS = weeks after sowing.

Days to 50% flowering

Table 9 show the Effects of Varieties and Herbicide on seedling vigor score. Varieties and herbicide rate had no significant effect on seedling vigor. Table 10 shows the Effects of Varieties and Herbicides on number of days to 50% flowering of sunflower. Varieties and Herbicide did not have significant effect on the number of days to 50% flowering of sunflower.

Table 9. The Effects of Varieties and Herbicide on seedling vigor score in Wet Season.

Treatment	2WAS
Variety	
Samsun1	1.50
Samsun 3	1.67
Local	2.42
S.E±	0.45
Herbicide Rate	
Butachlor 1kgai/ha	1.67
Butachlor 1.5kgai/ha	1.67
Hoe weeding	1.56
Weedycheck	2.56
S.E±	0.52

Means followed by the same letter(s) within a column and treatment group are not significantly different at P < 0.05. Using Duncan's New multiple Range Test (DMRT). WAS = weeks after sowing

Table 10: The Effects of Varieties and Herbicide on days to 50% flowering in Wet Season

Treatment	Days to 50%
Variety	
Samsun1	60.33
Samsun 3	61.33
Local	59.25
S.E±	1.63
Herbicide Rate	

Treatment	Days to 50%
Butachlor 1kgai/ha	61.33
Butachlor 1.5kgai/ha	60.00
Hoe weeding	59.44
Weedycheck	60.44
S.E±	1.88

Means followed by the same letter(s) with an column and treatment group are not significantly different at $P < 0.05$. Using Duncan's New multiple Range Test(DMRT). WAS = weeks after sowing.

Yield parameters

Table 11 shows the effect of variety and herbicides on yield parameters. Varieties and herbicides were significantly affected during the trial.

Grain weight/plot

SAMSUN1 gave the highest grain weight followed by SAMSUN 3. Local variety gave the lowest number of grain weight. Butachlor 1.5kgai/ha gave the highest grain weight/plot followed by butachlor 1kgai/ha, then hoe weeding. Weedy check gave the lowest grain weight/plot.

Hundred Seed Weight

SAMSUN 3 and SAMSUN1 variety of sunflowers gave the highest but comparable seed weight, while local variety gave the lowest 100 grain weight. Butachlor at 1.5kgai /ha and 1kgai/ha gave the highest and comparable 100 grain than hoe weeding and weedycheck which gave the lowest and comparable 100 grain. SAMSUN1 variety of sunflower gave the highest grain weight kg/ha followed by SAMSUN 3. Local gave the lowest grain weight kg/ha. The application of butachlor at 1.5khai/ha gave the highest grain weight kg/ha followed by butachlor at 1kgai/ha and hoe weeding. Weedy check gave the lowest grain yield kg/ha.

Number of Heads

Table 11 shows the number of heads of sunflower per plot. Varieties did not have significant effect on the number of heads of sunflower Buatchlor at 1kgai/ha, 1.5kgai/ha,

and hoe weeding gave comparable and highest number of heads than weedy check which gave the lowest number of heads.

Table 11. The Effects of Varieties and Herbicide on Yield parameters in Wet Season

Treatment	Grain Weight	Hundred Seed weight	Grain Weight kg/ha	No of heads
Variety				
Samsun1	510.33[a]	6.83[a]	1133.97[a]	17.50
Samsun 3	428.75[b]	6.33[a]	952.68[b]	18.67
Local	260.92[c]	5.33[b]	579.76[c]	18.33
S.E±	16.95	0.38	37.65	0.45
Herbicide Rate				
Butachlor 1kgai/ha	1003.84b	6.78[a]	1003.84[b]	18.56[a]
Butachlor 1.5kgai/ha	1171.74[a]	6.44[a]	1171.74[a]	18.89[a]
Hoe weeding	958.43[c]	5.89[b]	958.43[c]	18.33[a]
Weedycheck	421.18[d]	5,56[b]	421.18[d]	1.89[b]
S.E±	19.57	0.44	43.48	0.52

Means followed by the same letter(s) with an column and treatment group are not significantly different at $P < 0.05$. Using Duncan's New multiple Range Test (DMRT). WAS = weeks after sowing.

CONCLUSION

From the result obtained in the trial, the application of butachlor at 1.5kgai/ha to Sunflower (SAMSUN1) gave higher yield. Plant height, stem girth, days to 50% flowering and number leaves was not significantly affected in the trial. This insignificance of the varieties of the sunflower could be due to genetic makeup and adoption to local conditions. Herbicides did not have significant effect on stand count, plant height grasses, stem girth, and number of leaves at 6 and 9WAS. This could be due to the fact that at this stage, the plant is slow in growth. However, crop vigor score was significantly affected. This could be due to the initial effect of herbicide on the growth of the plants. The result indicted that

use of butachlor at 1.5kgai/ha plus supplementary hoe wedding (SHW) at 6 and 9 WAS produce significantly lower weed as well as higher weed control efficiency and higher grain yield per plot, followed by butachlor 1kg ai/ha then hoe weeding at 3, 6 and 9WAS. However, weeding check gave the lowest grain weight per plot and higher weed cover. This could mean that the herbicide was very effective in controlling the weed. In our study to investigate the different rates of herbicide (Butachlor) on weed and yield of sunflower, (butachlor) responded well to the Herbicide rates, SAMSUN1 yield more than SAMSUN3 and Local at 1.5kgai/ha rate of herbicide which is the highest yield recorded from the different rate of herbicide.

Declaration

Funding: Not applicable

Data Availability declaration: Not applicable

Consent to Participate declaration: Not applicable

Consent to Publish declaration: Not applicable

Ethical issues: Not Applicable

Competing interests: The author declares no conflict of interest

Declaration of Author Contributions

The authors declare that they have contributed equally to the article. All authors declare that they have seen/read and approved the final version of the article ready for publication.

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