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Original Article

Performance of Irrigated Sunflower (*Helianthus Annuus* L) and the Major Insects Attacking the Seeds

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Abstract

The first experiment was conducted at the Rainy season farm of the Institute of Agricultural Research (IAR) Ahmadu Bello University (ABU) Zaria behind National Agricultural Extension and Research Liaison Service in the year 2012and then the second at the Irrigation site of IAR in the year 2013. The objective of the work was to determine the performance of Sunflower in both Rainy and under irrigation and identify the major entomofauna that cause damage to the crop. Surface irrigation was used to supply water to the crop. The experiment was laid in a Randomised Complete Block Design consisting of five treatments which include watering after every two, three, four, five and six days. The result of the studies indicated that there was significant difference (P=0.05) between treatments that received water after every two and three days to those that received water after every four, five and six days. Similarly, there was significant difference between rains fed and irrigated sunflower regarding the yield. Rain fed sunflower gave an average of 800 Kg/ ha while irrigated sunflower gave an average of 1074 kg/ha. The major insects observed in irrigated sunflower were *Agonoscelisversicolor, Pachnodacordata, Sphaerocoristestudogrisear, Anoplocnemiscurvipes, Zonocerusvariegatus, Dysdercusvolkeri* and *Microtermis spp*. The result of the studies further indicated significant difference (P=0.05) between the rain fed and irrigated crop. Irrigated sunflower recorded the highest number of insects, pollinators, low number of empty achenes and lodged plants. The result also indicated that there was correlation between yield and plant establishment, capitulum diameter and Apismellifera. However, there is no correlation between yield and lodged and unfilled achenes but there was correlation between the number of Apismellifera and unfilled achenes.

Keywords: Entomofauna, Sunflower, Surface irrigation and yield.

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INTRODUCTION

Sunflower, (*Helianthus annuus* L.) (Magnoliopida: Asteraceae) is a common name for annual and perennial herbs of a genus of the family of composite flowers. The daily orientation of the flower to the sun is a direct result of differential growth of the stem due to a plant growth regulator or auxin, which accumulates on the shaded side of the plant when conditions of unequal light prevail. Because of this accumulation, the darker side grows faster than the sunlit side, thus the stem bends towards the sun (Robertson, 1975). Sunflower oil contains predominantly linoleic acid in triglyceride form and has smoothing properties and is considered non comedogenic (Praveena *et al.*, 2000). Sunflower oil is high in essential vitamin E and low in saturated fat. The two most common types of sunflower oils are linoleic and high oleic. Diets combined with a low fat content and high levels of oleic acid have been suggested to lower cholesterol which in turn results in a smaller risk of heart disease. The oil can be used in conditions with extremely high cooking temperatures. It may help food stay fresher and healthier for longer periods of time (Praveena *et al.,* 2000). Sunflower oil like other oils can retain moisture in the skin; however, it may also provide a protective barrier that resists infection. It is also sold as food for birds and can be used directly in cooking and as salads (Ogunremi, 1988). Sunflower oil, extracted from the seeds, is used for cooking, as carrier oil and to produce biodiesel, for which it is less expensive than the Olive product. Sunflowers also produce latex and are the subject of experiments to improve their suitability as an alternative crop for producing hypoallergenic rubber (Ogunremi, 1988). Similarly, sunflowers have been used to remove lead from contaminated soils in Post- Katrina, New Orleans and home owners suspicious of the soil in their own back yards use sunflowers prior to planting edible crops (Tunza 2010). Sound water management is essential to the success of sunflower crops (Duane, 2012). Adequate water and nutrient supply are important factors affecting optimal plant growth and successful crop production, water stress is one of the severe limitations of crop growth especially in arid and semi arid regions of the world as it has a vital role in plant growth and development. However depending upon plant species, certain stages such as germination, seedling or flowering could be the most critical stages for water stress Sham, *et. al.,* (2013). Seed germination is first critical and the most sensitive stage in the life cycle of plants Ashraf and Mehmood (1990) and the seeds exposed to unfavorable environmental conditions like water stress may have to compromise the seedlings establishment Albuquerque and Carvalho (2003). Sunflower being an oil seed crop is particularly susceptible to water shortage at germination stage. Sajjan *et al.,* (1990) reported decreased in percent germination and biomass accumulation in sunflower with increasing osmotic stress in germinating media where as mean germination time increased with increasing water deficit EL Midaoul *et al.*, (2001). Research and farmer testimony has demonstrated that sunflower responds to irrigation with yield increases of 100 to 200 percent over non irrigated one Hans, (2012). Water utilization by sunflower depends on a number of factors including variety, date of planting, timing of irrigation, soil types, fertility and plant populations, optimum utilization of water occurs if N.P.K. levels are sufficient for high yields. Robinson, (2011) reported that irrigation, fertilizer and irrigation plus fertilizer increased sunflower yields 35, 72, and 475 percent respectively. Water deficiency between flowering and maturity adversely influences yield more than at other times. Irrigation management becomes much more critical from early flowering until maturity. Irrigation should maintain soil moisture at 80% of field capacity at flowering stages and at 70% of field capacity at other times. Sunflower is thought to better withstand short periods of crop water stress than are corn and soybeans and the timing of critical sunflower water needs is offset from those of corn and beans Freddie (2011). Seed yield increased 30% and oil yields 48 % from irrigation 22 days after mid- flower Robinson, (2011). Several researchers have

therefore, investigated the possibility of large scale production of sunflower. Aspect of sunflower that have been looked into include performance testing of different varieties for adaptability, yield response of sunflower to plant population, chemical composition of sunflower and its varieties and different growth stages of the plant and planting date effects on yield and quality of sunflower (Owen, 1983). Sunflower head diameter is obtained by measuring the part of the head that includes the disk flower which vary from 6-75 cm (Heiser, 1976). Few or no studies have been conducted regarding performance of irrigated sunflower and its entomology in Nigeria particularly in the Northern part. As the crop is gaining popularity worldwide due to its high oil contents and its health promoting qualities, there was a need to identify the optimum irrigation frequency and key insect pests, their population changes.

MATERIALS AND METHOD

Experimental site

Preliminary study was conducted at the National Agricultural Extension and Research Liaison service (NAERLS) Farm in 2012 to determine different growth stages of sunflower and the time of infestation of *D. volkeri*. Further studies were conducted at the irrigation site of the Institute of Agricultural Research Samaru farm located at Latitude 11^0 10' N and Longitude 7^0 37' E in 2013 and 2014.

Experimental Materials and Sampling

The experimental materials used were pegs, rope, and sunflower accession called Funtua. Bags made from muslin cloth with a size of 45 cm by 50 cm were used to cage infested sunflower heads. Sampling started with the appearance of the insects on the crop i.e. at reproductive stage R7 and was done weekly by making visual count to determine the population dynamics.

Plant establishment

Plant establishment was taken for three weeks after germination from each water frequency. The number of stands from each plot was recorded.

Capitulum Diameter

Capitulum diameter was measured using a ruler to take the actual diameter. Where the capitulum form a concave a twine was used to measure it and then use the ruler to measure the twine. Average measurement of the five sampled capitulum was taken and used for the analysis.

Population of bees

Sampling of bees was taken at 10.00 am and at 4.00 pm and later average was calculated. Sampling was done for only 10 days that is the time assumed to be the pollination time of sunflower after blooming.

Lodged Plants

The number of lodged stands was taken from each plot for the four replicates. Average number of lodged plants was taken per treatment for analysis.

Unfilled achenes

The number of unfilled achenes was determined using fluctuation method for each plot. 1000 achenes were sampled using a marked plastic cup. The samples were immersed in water for a

period of one hour after which the empty achenes will remain on top so that it will be removed and counted.

Insect population

The observation on the insect pest's incidence in relation to phenologic growth stages of sunflower was recorded on 10 randomly selected plants. Weekly counting of each insect species and their population changes was taken as soon as the insect start appearing on the crop. The on-spot visual counting of insects in situ from germination or time of occurrence to maturity of the crop was done in the morning hours. Insect counts were only for those insects which occurred in large number and proved to be pestiferous. This type of pest was considered to be the key insect pests of sunflower.

Yield determination

On maturity, 4 central ridges were harvested to assess the yield for rainy season trials from each plot for each treatment. For the dry season the yield was assessed for the whole plot. The harvested heads were allowed to dry, gathered, threshed and winnowed. Yields were converted to kilogram per hectare after weighing using electrical balance Mitler 500.

Data analysis

Data was statistically analyzed by MSTAT-C software. Treatments were compared using the Duncan Multiple Range Test at 1% probability level.

RESULTS AND DISCUSSION

Plant establishment

The result of the studies indicated that there was significant difference (P=0.05) regarding the number of established plants as affected by frequency of irrigation (Table 1). The result showed that IP ^{2}and IP ^{3} recorded high number of established plants than IP ^{4}, IP ^{5} and IP ^{6}. In addition, irrigated sunflower showed significant difference with that of the rainy season. Irrigated sunflower had more number of established plants than rain fed. This may not be unconnected with uneven distribution of rain to the crop.

Capitulum diameter

The result of the study regarding the capitulum diameter indicated that plots that received water after every two and three days recorded the highest capitulum diameter of 14.44 cm and 14.49 cm followed by those that received water after every four and five days with 13.05 cm and 13.25 cm respectively. However, there is no significant difference (p=0.05) between IP^{6} and rainy season crop regarding capitulum diameter (Table 2).

***Apismellifera* population**

The result of the studies indicated that there is no significant difference among the IF, IF^{3}, IF^{4}, and IF^{5}. However, there was significant difference between IF^{6} and rainy season crop regarding the number of *Apismellifera*. IF^{2}, IF^{3}, IF^{4}, and IF^{5} had more number of *A. mllifera* than IF^{6} and rainy season crop (Table 3). This may be attributed to the amount of nectar the bee may get from more moist plants. Soil that receives much water may retain much moisture unless if porosity is high which may be available to the crop hence more amount of nectar and more number of foragers. In the rainy season, if the blooming time coincides with dry spell there is every tendency for the crop to produce little nectar and hence low number of foragers.

Lodging caused by *Microtermissp*

The result of the studies indicated significant difference between irrigated crop and that of the rainy season (Table 4).Lodging is more on rainy season crop than irrigated. Termite appeared as the moisture is running out in the R.S. thereby feeding on the hemicellulose which lead to breakage of the plant at the base. Lodging is also caused in some places by inability of the farmer to earthen up particularly on loose sandy loam coupled with heavy capitulum and wind.

Unfilled achenes or hollow seededness

The result of the studies indicated no significant difference between $IF^2$and IF^3 regarding percent unfilled achenes (Table 5). Also IF^4, IF^5 IF^6 and rainy season crop showed no significant difference regarding percent unfilled achenes. Percent unfilled achenes was more on RS and that of IF^4, IF^5 and IF^6. The result is in conformity with the statement made by Freddie (2011) who stated that sunflower can only withstand water for a short period of time.

Sunflower Yield

The result of the study indicated no significant difference between IF^2(1007 kg/ha) and IF^3(1404.6kg/ha) and between IF^4(1089.6 kg/ha) and IF^5 (978.4 kg/ha)and between IF^6 (970 kg/ha) and RS (882.2kg/ha) crop regarding the yield (Table 6). Rain fed crop yield less than the irrigated crop. This may not be unconnected with undistributed supply of moisture to the crop. In the rainy season the crop may encounter moisture stress at any point of growth and this may affect the performance of the crop. The study is in conformity to that of (Anon, 1998) who stated that rainfed crop yields 800-1000 kg/ha while with irrigation the yields are about 2000 kg/ha.

CORRELATION

The result of the studies indicated that there was correlation between yield and plant establishment (0.394), capitulum diameter (0.73), *A. mellifera* (0.730). However, there is no correlation between yield and lodged plants (0.370) and unfilled achenes (0. 749) but there is correlation between *Apis mellifera* and unfilled achenes (0. 703).

Table 1: Effects of irrigation frequency on plant establishment Mean percent plant establishment

Replications Irrigation Frequency (IF)	1	2	3	4	5	Grand Mean
IF^2	69	72	71	71	72	72.20a
IF^3	74	73	73	71	70	72.00 a
IF^4	70	71	69	70	71	70.20 b
IF^5	69	70	71	68	70	69.60 b
IF^6	66	67	68	67	66	67.00c
Rainy season (R.S)	67	70	68	67	66	68.00c
DMRT						

Legend:-IF^2, IF^3, IF^4, IF^5, IF^6mean irrigation after two, three, four and five days respectively

-Means followed by the same letters are not significantly different at P= 0.05.

Table 2: Effect of irrigation frequency on Capitulum diameter Mean number of Capitulum diameter (cm)

	Replications					
Irrigation Frequency (IP)	1	2	3	4	5	Grand Mean
IF^2	14.32	14.93	14.15	14.05	14.05	14.38b
IF^3	15.56	16.43	14.67	15.35	7. 45	15.89a
IF^4	13.25	13.44	13.65	12.44	12.45	13.05c
IF^5	12.00	13.46	12.45	12.55	12.11	12.51b
IF^6	11.23	11.34	11.50	11.46	11.71	11.45d
Rainy Season (R.S.)	11.21	11.05	11.41	10.44	11.67	11.16d
DMRT						

Legend: -IF^2, IF^3, IF^4, IF^5, IF^6mean irrigation after two, three, four and five days respectively
-Means followed by the same letters are not significantly different at P= 0.05.

Table 3: Effect of irrigation frequency on number of *Apismellifera*.

Mean number of *Apismellifera*

	Replications					
Irrigation Frequency (IP)	1	2	3	4	5	Grand Mean
IF^2	11.00	11.00	10.00	11.00	11.00	10.88a
IF^3	10.00	11.00	12.00	11.00	13.00	11.40a
IF^4	10.00	10.00	11.00	11.00	13.00	11.00a
IF^5	10.00	09.00	08.00	07.00	10.00	08.80a
IF^6	07.00	06.00	06.00	07.00	06.00	
	06.40b					
Rainy Season (R.S)	09.00	07.00	06.00	08.00	07.00	07.40c
DMRT						

Legend: IF^2, IF^3, IF^4, IF^5, IF^6mean irrigation after two, three, four and five days respectively
-Means followed by the same letters are not significantly different at P= 0.05.

Table 4: Effect of irrigation frequency on damage by termite

Mean Percent of lodged plants per plot

	Replications					
Irrigation Frequency (IP)	1	2	3	4	5	Grand Mean
IF^2	2.00	3.00	1.00	0.00	1.00	1.40b
IF^3	1.00	1.00	1.00	2.00	0.00	1.00b
IF^4	1.00	0.00	0.00	1.00	0.00	1.20b
IF^5	1.00	2.00	1.00	1.00	0.00	1.00b
IF^6	0.00	1.00	2.00	1.00	0.00	0.60b
Rainy Season (R.S)	06.00	10.00	21.00	22.00	40.00	21.20a
DMRT						

Legend: IF^2, IF^3, IF^4, IF^5, IF^6mean irrigation after two, three, four and five days respectively
-Means followed by the same letters are not significantly different at P= 0.05.

Table 5: Effect of irrigation frequency on unfilled achenes

Mean Percent of unfilled achenes						
	Replications					
Irrigation Frequency (IP)	1	2	3	4	5	Grand Mean
IF^2	3.00	2.00	2.00	2.00	3.00	2.40c
IF^3	3.00	3.00	2.00	2.00	2.00	2.40c
IF^4	4.00	3.00	5.00	4.00	6.00	4.40c
IF^5	5.00	4.00	5.00	4.00	4.00	4.00c
IF^6	12.00	5.00	8.00	10.00	12.00	9.40b
Rainy Season (R.S)	10.00	13.00	11.00	10.00	13.00	11.40a
DMRT						

Legend: IF^2, IF^3, IF^4, IF^5, IF^6mean irrigation after two, three, four and five days respectively
-Means followed by the same letters are not significantly different at P= 0.05.

Table 6: Effect of irrigation frequency on yield of sunflower

Mean yield of Sunflower Kg/ha						
	Replications					
Irrigation Frequency (IP)	1	2	3	4	5	Grand Mean
IF^2	1041	953	1025	945	1075	1008b
IF^3	1001	1024	1795	1656	1643	1423.8a
IF^4	1150	1096	1123	1031	1048	1089.6b
IF^5	985	978	969	974	986	978.4b
IF^6	977	986	967	956	964	970b
Rainy Season (R.S)	876	877	884	873	901	882.2b
DMRT						

Legend: IF^2, IF^3, IF^4, IF^5, IF^6mean irrigation after two, three, four and five days respectively
-Means followed by the same letters are not significantly different at P= 0.05.

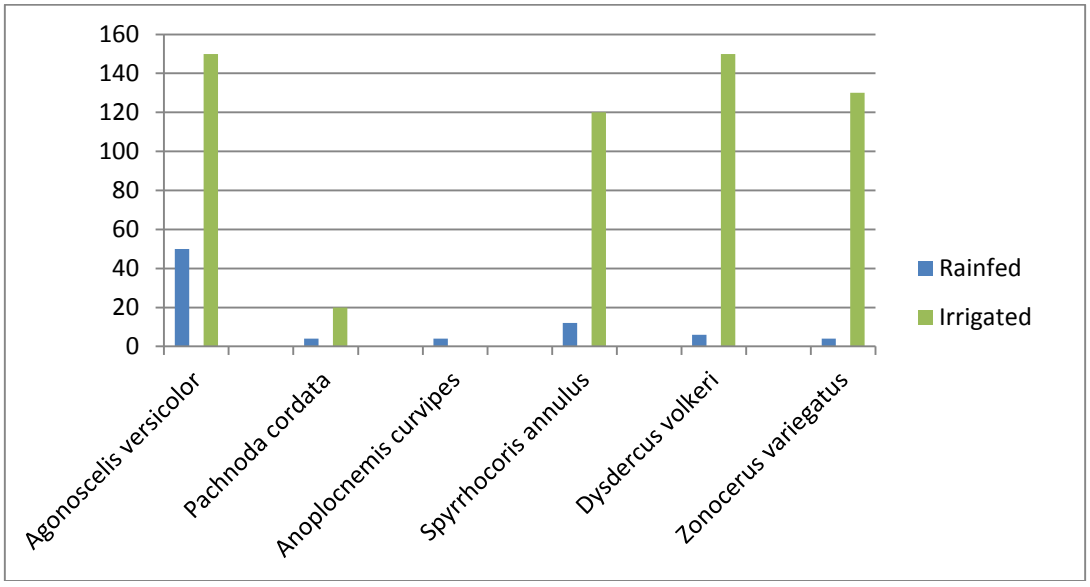

Fig: 1 Population of Key Insect pests of sunflower under irrigation and rainfed condition.

Conclusion

The studies indicated that sunflower crop that received water after every two and three days gave better yield than those that received water after every four, five and six days. Rain fed sunflower gave an average of 800 Kg/ ha while irrigated sunflower gave an average of 1074 kg/ha. The major insects observed in irrigated sunflower were *Agonoscelis versicolor, Pachnoda cordata, Sphaerocoris testudogrisear, Anoplocnemis curvipes, Zonocerus variegatus*, *Dysdercus volkeri* and *Microtermis spp*. Irrigated sunflower recorded the highest number of insects and pollinators which may not be unconnected with low number of available plants that served as food.

REFERENCES

Army R. (2010). Sunflower irrigation techniques. *Home Guides SF Gate.*, Pp 4-8

Duane, B. (2012). Performance of Irrigated Sunflower in North Dakota State University. *Drought* 1-3.

Hans, K. (2012). Sunflower irrigation and varietal performance in North Dakota. *NDSU Extension Bulletin* pp 3-7

Joel, S. (2011). Sunflower irrigation for best yield. *NDSU Extension Bulletin* pp 2-10

Shamm, A.I., A. I. Rashid, Y. A. Muhammad, M. Ashraf, A.W. Ejaz, (2013). Response of sunflower to drought stress at germination and seedling growth stages.