



Effect of Irrigation Intervals, Nitrogen Levels and Weed infestation on Triticale (*Triticale Triticosecale wittmack*)

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ABSTRACT

Field experiment was conducted during 2014, 2015 and 2016 dry seasons at Sau lawa (Latitude 12°40'11"N and Longitude 7°48'19"E) in Katsina State, to study the response of triticale (*Triticale triticosecale wittmack*) to irrigation intervals at (5, 7 and 9 days), nitrogen levels (0, 60, 90 and 120 kg N ha⁻¹) and weeding regimes (No weeding, one weeding at 20 days after sowing (DAS) and two weeding at 20 and 40 DAS). The treatments were arranged in a split plot design with three replications. Irrigation intervals were allocated to main plot while factorial combinations of nitrogen levels and weeding regimes were allocated to the sub-plots. Data collected were subjected to analysis of variance. Among the grasses identified *Imperata cylindrical* was the most frequent weed species while *Acanthospermum hispidum* was the most frequent within the broad leaved. Significantly lower weed infestation was observed at 5 days irrigation interval, 120 kg N ha⁻¹ and weeding done twice at 20 and 40 DAS, produced significantly less number of weeds, minimum weed density and weed dry weight. Irrigation interval of 5 days, application of 120 kg N ha⁻¹ and two weeding done at 20 & 40 DAS is suggested for triticale production in the study area of Sudan savanna ecological zone of Nigeria.

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INTRODUCTION

Triticale (*Triticale triticosecale* Wittmack) is a hybrid cereal crop developed by crossing wheat (*Triticum turgidum* or *Triticale aestivum*) and rye (*Secale cereale*) pollen. The objective of making wheat/rye crosses was to capture the best traits of each species. Wheat yields and grain qualities are better than rye. But rye has better disease resistance and better tolerance to environmental stress. Triticale has similarities with wheat but varies significantly in plant height, larger inflorescence, high grain yield, resistance to biotic and a biotic stresses and valuable grain composition (Zecevic *et al.*, 2010). Despite these features, triticale grain is used as a fodder crop for livestock feed, in making porridge, bread, pasta, pastry and beer (Amaya and Pena, 2011).

According to FAO (2019), the sown area of triticale (both winter and spring cultivars) in the world increased from 2.49 million ha to 3.81 million ha, growing at an average annual rate of 2.47%. The world production of triticale was 14,060,433 t ha⁻¹ and yield of 36,927 kg ha⁻¹. The primary producers of triticale are Poland, Germany, Belarus, France and Russia.

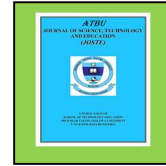
Weeds are unwanted plants, which succeed in the struggle for existence in competition with crops. Weed infestation is a major constraint in crop production lowering the yield and quality of the produce. They can substantially reduce yield without obvious signs of damage (Lavabre, 1991). An increase in grain yield of 31.2% was reported when weeds were effectively controlled in wheat (Dadari *et al.*,

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2000). Subsistence farmers in the tropics spend more time, energy and money for weed control than any other aspect of crop production. Weed control is a basic requirement and a major component of production systems (Hossain *et al.*, 2011). Generally, weed-free condition is essential for obtaining optimum crop yield. This can be achieved by removing the weeds through different weed control methods.

Water is one of the most important factors that are necessary for proper growth and higher yield of all crops. Water deficiency affects plant growth and grain yield (Hussain *et al.*, 2010; Wajid *et al.*, (2011). Water deficiency in crops retards not only the growth of the plants but also results in poor harvests thereby causing a great financial loss to the farmer. Proper irrigation scheduling is essential for the efficient use of water, energy and other production inputs. Proper irrigation interval has been identified to significantly decrease weed infestation in wheat (Lado *et al.*, 2005).

Plant nitrogen nutrition has a great impact on the technological quality of triticale cultivars. Nitrogen, in interaction with other mineral elements, plays a significant role in the triticale yield and quality. For high yield and grain quality, it is necessary to provide nitrogen to the plant during the whole vegetation period (Hosseini *et al.*, 2011).

Among the major constraints affecting crop production in Nigeria, Fadayomi (2010) ranked weeds as the number one pest which farmers are well familiar with in causing crop loss between 40 to 100%. Weeding improved highest plant height which might be due to the availability of more nutrients from a weed free environment as reported by Lado (2005) and due to less competition Dadari *et al.*, (2000). The objective of the study was to investigate the effect of irrigation intervals, nitrogen levels and weeding regimes on triticale.

MATERIALS AND METHODS

A field experiment was conducted during the 2013/2014, 2014/2015 and 2015/2016 dry seasons under irrigation from November-March at the Saulawa Irrigation Site in Bindawa

Local Government of Katsina State, located in the sudan savanna agro-ecological zone of Nigeria (Latitude 12° 40' N and longitude 7° 48' E at an altitude of 465m above sea level). The area has a long dry season that is characterized by cool dry air during harmattan from November to February and hot dry air during hot season from March to May. Rainfall in the area lasts for 4-5 months in a year, starting from late May or early June to September/October. Long term mean annual rainfall in the area is reported to be 600 mm. Potential evapo-transpiration is about 1700-1800 mm per annum and the mean annual temperature ranges from 14°C to 38°C (Google Earth, 2017).

The treatments consisted of irrigation intervals at (5, 7 and 9 days), four nitrogen levels (0, 60, 90 and 120 kg N ha⁻¹) and weeding regimes (No weeding, one hoe weeding at 20 days after sowing (DAS) and two hoe weedings at 20 and 40 DAS). The experiment was laid out in split-plot design with three replications. Irrigation was allocated to main plot while factorial combinations of nitrogen levels and weeding regimes were allocated in sub-plots.

The land was cleared manually and then ploughed, harrowed, leveled and made into appropriate plots. Basins were constructed manually and the borders were raised to 10 cm height to minimize seepage. Plots were marked out with 1.0 m irrigation channels. Gross plot size was 6 x 1.38 m (9.28 m²) and net plot size was 5 x 0.92 m (4.60 m²). Distance of 0.5 m between subplots and 2 m between main plots and between blocks was maintained throughout the trial period.

In each season, the spring triticale seeds variety 'Abase' was obtained from the Department of Agronomy, Bayero University, Kano. The seed were sown on 15th November each year by drilling method at 2 cm depth at the seed rate of 120 kg ha⁻¹. A spacing of 23 cm between rows and 5 cm from plant to plant was maintained. There were six rows in each sub-plot.

Irrigation was carried out by surface flooding in which each plot is filled to capacity using channels from tube-well. For the first two weeks after sowing, irrigation was carried out at

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five days interval, thereafter the irrigation treatments was imposed accordingly. Nitrogen was applied in form of NPK 15:15:15 and urea. Half of the N in form of NPK was applied at sowing while the remaining half was applied at 40 DAS. Weeding was carried out according to the treatments and weed occurrence, weed dry weight and weed density were recorded accordingly.

The species of weeds within 0.5 m² quadrat were identified, counted and recorded at prior to weeding at 30 DAS. Weed collected were pressed as herbarium specimen and identified by using a hand book of West African Weeds (Akobundu and Agyakwa, 1987). Weed samples were collected from three random 0.5 m² quadrat along a diagonal transect in each plot. Weed occurrence was rated visually using a scale of 0-5 where 0 = no weed occurrence and 5 maximum weed occurrence.

The weed density was calculated using the formula of Das

$$Density = \frac{\text{Total number of individual}}{\text{Number of quadrats studied}}$$

This data was taken at each weeding regimes. Weeds within 0.5 m² quadrat were uprooted, dried first in the sun and thereafter for 24 hours in an electric oven maintaining a

constant temperature of 75 °C, after drying the samples were weighted to express the mean weed dry weight in g m⁻², and this was converted to kg ha⁻¹. Data generated from the experiment were subjected to analysis of variance using whole model statistical software and means were separated and compared using Tukey's Studentized Range Test (HSD) as described by Gomez and Gomez (1984).

RESULTS

The result shows in table 1, the Cumulative weed flora composition at 30 days after sowing (DAS). About 11 weed species were identified; out of which 6 belong to broad-leaved, 3 grasses and 2 sedges. Nine different weed species were recorded in 2013/2014 dry season, while 6 each were recorded in 2014/2015 and 2015/2016 respectively. Among the weed grasses, *Imperata cylindrical* was the most frequent species in the trial site while *Acanthospermum hispidum*, was the most frequent within the broad leaved weeds and two different weed species (*Amaranthus spinosus* and *Digitaria horizontalis*) that were absent in 2013/2014 while a total of 5 weed species each were absent in 2014/2015 and 2015/2016 dry seasons respectively.

Table 1: Cumulative weed flora composition at 30 Days after sowing of Triticale

Weed species	Plant Family	Growth Form	Degree of Occurrence		
			2013/2014	2014/2015	2015/2016
<i>Acanthospermum hispidum</i> (L.)	Asteraceae	ABL	XXX	XXX	XX
<i>Agerathum conyzoides</i> (L.)	Asteraceae	ABL	XX	XX	0
<i>Amaranthus spinosus</i> (L.)	Amaranthaceae	ABL	0	0	X
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	PS	X	X	X
<i>Cyperus esculetus</i> (L.)	Cyperaceae	PS	XX	X	0
<i>Digitaria horizontalis</i> (Willd.)	Poaceae	AG	0	0	X
<i>Eleusine indica</i> (Gaertn.)	Poaceae	AG	XX	0	0
<i>Imperata cylindrical</i> (L.) R.	Poaceae	PG	XXX	XXX	XXX
<i>Leucas martinicensis</i> (Jacq.)	Malvaceae	ABL	X	X	0
<i>Mitracarpus villosus</i> (Sw.) DC.	Malvaceae	ABL	X	0	0
<i>Spermacoce verticillata</i> (L.)	Rubiaceae	ABL	X	0	X

ABL = Annual Broad- leaf, 0 = No weed occurrence, AG = Annual Grass, X = Low Weed Occurrence
PG = Perennial Grass, X = Medium Weed Occurrence, PS = Perennial Sedge XXX = High Weed Occurrence

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The result presented in Table 2, Irrigation interval had significant effect on weed density in all the three year trials. Irrigation at 9 days intervals produced the highest weed density, followed by irrigation at 7 days and 5 days interval produced the least weed density. Nitrogen level has highly significant effect ($P \leq 0.01$) on weed density throughout the period. Lowest weed

density was obtained in 120 kg N ha⁻¹ plots while the highest weed density was obtained in the control plots. Weeding regime had significant effect on weed density stages for all the three year trials. Weeding done twice at 20 and 40 DAS produced the least weed dry weight while the highest weed dry weight was obtained in the unweeded plots.

Table 2: Response of Triticale to Irrigation interval, Nitrogen level and weeding regime on Weed Density at 60 Days after sowing

Treatments	2013/2014	2014/2015	2015/2016
Irrigation interval (days)			
5	2.77c	2.69c	2.69c
7	3.29b	3.29b	3.92b
9	3.65a	3.82a	4.36a
Level of Significance	**	**	**
SE±	0.041	0.021	0.072
Nitrogen level (kg ha ⁻¹)			
0	3.44a	3.53a	3.665
60	3.28ab	3.34b	3.662
90	3.13b	3.18c	3.656
120	3.09b	3.00d	3.630
Level of Significance	**	**	NS
SE±	0.052	0.023	0.092
Weeding regime (days)			
0	3.88a	3.86a	3.76a
1	3.16b	3.26b	3.76a
2	2.67c	2.67c	3.45b
Level of Significance	**	**	**
SE±	0.042	0.021	0.072
Interactions			
I * N	NS	NS	**
I * W	NS	**	**
N * W	NS	**	NS
I * N * W	NS	NS	NS

Means followed by similar letter (s) were not statistically different at 5% level of probability using Tukey HSD. NS = Not significant ** = Significant at 1% level of probability

The result presented in Table 3 shows that Weed dry weight was significantly ($P \leq 0.01$) affected by irrigation interval. Increase in irrigation intervals increase the weed dry weight. Irrigation at 5 days interval produced the lowest weed density, further more increase in irrigation interval produced more weed dry weight, except in 2015/2016 dry season were irrigation interval of 5

and 7 days were statistically similar. Nitrogen fertilizer had significant effect on weed dry weight at all the growth stages in the three year dry seasons.

Weed dry weight significantly decreases with increase in nitrogen level. 120 kg N ha⁻¹ produced least weed dry weight and the highest weed dry weight was recorded in the control trial.

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Weeding had significantly ($P \leq 0.01$) affected weed dry weight for the period under consideration. Weeding done twice at 20 and 40 DAS produced the least weed dry weight followed by one weeding regime at 20 DAS and highest weed dry

weight was obtained in the un-weeded trial. The interaction was not significant between the treatment factors on this parameter were not significant in all the seasons.

Table 3: Response of Triticale to Irrigation interval, Nitrogen level and weeding regime on Weed Dry Weight (kg ha^{-1}) at 60 Days after sowing

Treatments	2013/2014	2014/2015	2015/2016
Irrigation (days)			
5	232.85c	277.08c	224.76b
7	277.01b	321.67b	225.76b
9	307.73a	367.88a	329.84a
Level of Significance	**	**	**
SE \pm	3.81	4.37	2.46
Nitrogen (kg ha^{-1})			
0	290.25a	346.97a	283.74a
60	276.38ab	332.83ab	267.24b
90	263.27b	318.04b	251.06c
120	260.23b	291.03c	238.46d
Level of Significance	**	**	**
SE \pm	4.40	5.05	2.85
Weeding (DAS)			
0	327.11a	381.29a	308.19a
1	266.41b	325.46b	259.85b
2	224.08c	259.88c	212.33c
Level of Significance	**	**	**
SE \pm	3.81	4.37	2.46
Interaction			
I * N	NS	NS	NS
I * W	NS	NS	NS
N * W	NS	NS	NS
I * N * W	NS	NS	NS

Means in columns or rows followed by similar letter (s) were not statistically different at 1% level of probability using Tukey HSD.

NS = Not significant

** = Significant at 1% level of probability

DISCUSSION

The effect of irrigation intervals on weed density and weed dry weight was significant during all the three dry seasons. Irrigation at 9 days interval produced more number of weeds, highest weed density and weed dry weight. This indicated that weeds compete better with triticale under moisture stressed condition. In 5 days irrigated plot, weed growth is suffocated due to water logging which inhibits growth due to low

oxygen concentration for roots respiration (Lado, 2005). Several findings have indicated that weed dry weight depends on the duration of

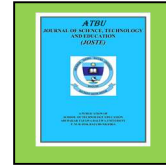
Interference between crop triticale as well as density of the weeds. Weed dry weight was highest at 9 days interval, suggesting that under moisture stressed condition, the relative competitiveness of weeds was enhanced. This observation was supported by Stroud (1993) in which he noted that as water become more

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limiting weeds have greater competitive ability than the crop. Irrigation at 5 days interval produced the lowest weed dry weight in all the treatment combinations probably because of moisture at this level is high enough to restrict root development.

CONCLUSION

The results obtained revealed that irrigation interval of 5 days, application of 120 kg N ha⁻¹ is suggested for higher triticale growth and yield, based on the finding of this result, it may be recommended that applying 120 kg N ha⁻¹ and two weeding done at 20 & 40 DAS is suggested for triticale production in Saulawa area of Sudan savanna ecological zone of Nigeria.

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