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Intercrops With Trap Crops, Nitrogen Fertilizaiton For *Striga Hermonthica* (Del.) Benth Control At Niger State

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ABSTRACT: *Field trial was conducted in the rainy season on a naturally heavily Striga-infested field in Bosso local goverment area in Niger State to determine the effect of intercroppping (soyabean and groundnut) and nitrogen (N) fertiliztion on two varieties of maize (Jo- 98 and local) intercropped with soyabean and groundnut at three level of N application (0, 50 and 100kgNha^{-1}). The experiment was layout in a randomised complete block design (RCBD) with three applications. The results indicated that there was highly significant (P = 0.01) effect on the effect of variety and intercropping on the days from planting to Striga emergence, effect of variety and N-rate on number of days from planting of maize to Striga emergence to 50% flowering. The effect of variety and intercropping on the severity of Striga infestation, the effect of N-rate and variety on the severity of Striga infestation, effect of variety and intercropping and nitrogen rate interaction on the severity of Striga infestation. Also, there was significant (P = 0.05) in the effect of intercropping n days to 50% tasseling and height of maize plant at date of first Striga emergence (cm). Effect of variety and intercropping on maize plant at matuirty and dry weight of whole maize plant production (g) at maturity, effect of variety and N-rate on the grain yield and intercropping on number of days from planting to 50% silking and 50% maturity.*

Keywords: *Intercropping, maize variety, Nitrogen fertilization, Striga hermonthica management.*

I. INTRODUCTION

Striga is typically linked to more intensive cereal production and as such the potential production improvements resulting from the use of improved varieties and production techniques were often not realized due to the losses caused by this parasitic witchweed (*Striga hermonthica* (Del.) Benth.). the enormous lossses caused by *Striga* to small farmers were well recognised. However the prospects for finding practical soluations seemed very limited. In reducing the devasting effects of *Striga*, an integrated past management package combining host plant resistance, chemical seed treatment , biological control and crop rotations should be considered.

The weed is difficult to control because of the build-up of a large reserve of its seeds in the soil which remain viable for many years. Kanampiu et al., (2003) reported that the *Striga* problem has continues to increase and as a result, farmers are forced to abandon *Striga* infested fields.

Several methods of controlling the weed are recommended, but are either incompatible with the cropping system or expensive. Cost effective alternative control methods that are acceptable to small-scale farmer are needed. Effort have been made to indentify chemicals that could either inhibit or stimulate *S. hermonthica* seeds germination.

Gworgwor et al., (2002) reported that soaking millet (*Pennisetum glaucum* (L.)) R.Br. seeds in cow urine for about 6-7 hour supported less emergence of S. *hermonthica* shoots.

Also Kanampiu et al., (2003) reported that maize seed coating with Imazapyr and Pyrithiobac provide *Striga* control throughout the season.

Reda et al., (2002) indicated that intercropping has in many instances shown promise as a low-cost method of controlling *Striga*. Aliyu et al., (2004) also indicated that intercropping can be a useful alternative to optimise yield and maintaining soil fertility.

Mgema and Mbwaga (2002) reported that nutrient status of the soil, especially nitrogen and either insufficient rain or poorly distributed rainfall promote *Striga* build-up, and both *Striga* shoot count and dry matter production were significantly decreased by nitrogen application on maize crop.

In all case, 100kg/N/ha resulted in signiicantly lower *Striga* shoot count than 50kg/N/ha while 100kg/N/ha was only lower at 9 weeks after sowing and at harvest. At lowest, shoot count of *Striga* decreased with incresing nitrogen level.

Adagba (2000) observed that applicaton of 90kg/N/ha consistently delayed and reduced *Striga* emergence, caused low *Striga* damage to the crop compared with no nitrogen and result in increased grain yield.

II. MATERIAL AND METHODS

A field trial was conducted during the 2010 cropping season on a naturally *Striga* infested field in minna (9^0 37^1 and 6^0 32^1 E) in southern Guinea Savanna agro-ecological zone of Nigeria. Tte site was manually cleared and ridges were constructed 75cm apart using hoe. The main plot size was 4 x 5m and 4 x 2.5m sub-plots each with five 2.5m long ridges two maize varieties (J0 – 98 (*Striga* resistant) and local (*Striga* susceptible) were intercropped with either soyabean (Samsoy 2) or groundnut (local variety) at three levels of (N) fertilization, O, 50 and 100kgN/ha. The treatment were randomly laid out in randomised complete block design (RCBD) with three replications. Crop were planted on 15th July 2010. Soyabean or groundnut were sown on the ridges in the designated plots at a spacing of 75cm intra- row spacing, maize was sown by the side of the ridges at 75cm x 25cm spacing. Compound fertilizer (NPK 20:10:10) was applied at 3 WAS at the rate of 60kg N, 30kgP and 30kgK in a single dose since high rates would reduce S. *hermonthica* growth, but Nitrogen fertilizer (Urea) was however applied only to those plots where it was prescribed as a treatment and at the appropriate rate. Manual hoe weeding was carried out at three weeks after sowing and hand pulling of weeds other than *Striga hermonthica* was adopted at four weeks after sowing (WAS) maize in order to avoid damage to *Striga* shots.

Data were also collected on *Striga*, maize, data on effect of variety and intercropping on the days from sowing to *Striga* emergence, effect of variety and N-rate on number of days from sowing of maize to *Striga* emergence, the effect of variety and N-rate on the number of days from *Striga* emergence to 50% flowering, the effect of variety and intercropping on the severity of *Striga* infestation, the effect of N-rate and variety on the severity of *Striga* infestation, effect of variety and intercropping and nitrogen rate interaction on the severity of *Striga* infestation. Effect of intercropping on day to 50% taselling and height of maize plant at date of first *Striga* emergence (cm), effect of variety and intercropping on maize plant at maturity and dry weight of whole maize plant production (g) at maturity, effect of variety and N-rate on the grain yield of maize plant (g) and effect of variety and intercropping on number of days from planting to 50% silking and 50% maturity, efffect of variety and intercropping on grain yield of maize per plant, effect of variety and intercropping on 1000 seed weight (g) of the data were subjected to analysis of variance using Genstat 5 release 3.2 (PC/windows 95) copyright 1995. Significant treatment means were compared using fisher's least significant difference test (F-L.S.D) at 5% and 1% levels of probability as described by Obi (2002).

III. RESULTS

The effect of intercropping on the days from sowing of maize to *Striga* emergence was highly significant (Table 1) J0 – 98 intercropped with groundnut delayed *Striga* emergence compare to J0- 98 and local maize only and maize intercropped with soyabean, also there was significant difference between the varieties the J0 – 98 resistant variety delayed *Striga* shoot emergence compared to local at all level of treatment.

The effect of N-rate on the member of days from sowing to *Striga* emergence was also highly significant (Table 2) days to *Striga* emergence was longer at 100kgN/ha compared to other treatment (0, and 50kg). However J0-98 resistant varieties delayed *Striga* emergence at 100kgN/ha than all other treatments. Variety x N-rate interaction was non-significant on days to *Striga* emergence.

There was significant difference n the effect of nitrogen rate on the number of dats from *Striga* emergence to 50% flowering at the levels of nitrogen tested. There poor *Striga* emergence generally in J0-98 intercropped with either soyabean or grundnut so *Striga* emergence was delayed and as such many of the plants could not even flower, so at 0kgN/ha *Striga* flowered earlier and reached 50% flowering earlier compard to 50 and 100kg N/ha (Table 3).

Table 1: Effect of variety and intercropping on the days from sowing to *striga* emergence

Intercropping	Maize variety		
	J0-98	Local	Mean
Maize only	60.1	51.3	56.0
Maize + Soyabean	65.1	58.1	62.0
Maize + groundnut	69.3	56.9	63.1
Variety Mean	64.8	55.4	-

F-L.S.D (0.01) for comparing variety (V) means = 3.4
F-L.S.D (0.01) for comparing intercropping (I) means = 4.4
F-L.S.D (0.01) for comparing V x I interaction = 6.3

Table 2: Effect of variety and Nitrogen rate on the number days from sowing to *striga* emergence

Nitrogen rate ($kgNha^{-}$)	Maize variety		
	J0-98	Local	Mean
0	57.2	50.9	54.1
50	61.4	59.2	60.3
100	68.1	62.5	65.3
Variety Mean	62.2	58.0	-

F-L.S.D (0.01) for comparing variety (V) means = 4.6
F-L.S.D (0.01) for comparing intercropping (I) means = 5.1
F-L.S.D (0.01) for comparing V x I interaction = 6.4

Table 3: Effect of variety and Nitrogen rate on the number days from sowing to *striga* emergence to 5% flowering

Nitrogen rate ($kgNha^{-}$)	Maize variety		
	J0-98	Local	Mean
0	20.2	25.4	23.0
50	23.4	25.1	24.3
100	28.4	22.2	25.3
Variety Mean	24.0	24.2	-

F-L.S.D (0.01) for comparing variety (V) means = 1.2
F-L.S.D (0.01) for comparing intercropping (I) means = 1.4
F-L.S.D (0.01) for comparing V x I interaction = 1.8

The effect of variety on the severity of *Striga* infestation was significantly different, *Striga* infestation was less in J0-98 resistant variety compare to local (susceptible). However, the local variety intercropped with groundnut perfrom better than J0-98 maize only. The intercropped with soyabean is not significantly different with groundnut but both intercropped treatment at 100kgN/ha significantly reduced *Striga* infestation. The interraction effect between the intercropped and N-rate was significant (Table 4)

Tabe 5 shows that significant difference in the effect of nitrogen rate on the severity of *Striga* infestation, the *Striga* infestation was most severe at 0kgN/ha within the test levels in J0-98 and similar reaction was observed in the local variety. However, 100kgN/ha significantly reduced *Striga* infestation. J0-98 resistant variety highly reduced infestation compared to the local susceptible variety.

Table 6 also shows that the interaction of intercropping and N-rate was significant, the highest severity of *Striga* infestation was at 0kgN/ha in both varieties and the lowest was at 100kgN/ha.

Table 4: Effect of variety and intercropping on the severity of *striga* infestation (%)

Intercropping	Maize variety		
	J0-98	Local	Mean
Maize only	40.1	70.2	55.2
Maize + Soyabean	13.8	58.2	36.0
Maize + groundnut	12.3	49.9	31.1
Variety Mean	22.1	59.4	-

F-L.S.D (0.01) for comparing variety (V) means = 11.4
F-L.S.D (0.01) for comparing intercropping (I) means = 22.6
F-L.S.D (0.01) for comparing V x I interaction = 46.3

Table 5: Effect of N-rate and variety on the severity of *striga* infestation (%)

Nitrogen rate ($kgNha^{-1}$)	Maize variety		
	J0-98	Local	Mean
0	23.2	46.4	34.8
50	17.5	38.1	27.8
100	5.4	21.2	13.3
Variety Mean	15.4	35.2	-

F-L.S.D (0.01) for comparing variety (V) means = 7.3
F-L.S.D (0.01) for comparing intercropping (I) means = 24.1
F-L.S.D (0.01) for comparing V x I interaction = 39.6

Table 6: Effect of variety, intercropping and Nitrogen rate interaction on the severity of *striga* infestation (%)

Intercropping/ maize Variety	Nitrogen rate ($kgNha^{-1}$)			
	0	50	100	Mean
Maize only (J0-98)	**62.2**	**39.2**	**9.4**	**36.9**
Maize only (Local)	**82.2**	**40.4**	**30.4**	**51.0**
J0-98 + Soyabean	**19.4**	**14.2**	**6.8**	**13.5**
Local +Soyabean	**50.1**	**20.8**	**10.8**	**27.2**
J0-98 + groundnut	**13.2**	**6.2**	**4.3**	**7.9**
Local + Groundnut	**45.2**	**19.3**	**7.6**	**24.0**
N-rate mean	**45.4**	**23.4**	**11.6**	**-**

F-L.S.D (0.01) for comparing variety (V) means = 20.6
F-L.S.D (0.01) for comparing intercropping (I) means = 14.9
F-L.S.D (0.01) for comparing V x I interaction = 42.4

Striga resistant maize variety intercropped with groundnut took shorter time to tassel than local maize only while there was no significant difference between other treatment. The main effect of variety and intercropping on the height of maize plant at date of *Striga* emergence was significant. J0-98 intercropped with soyabean and J0-98 intercropped with groundnut differed significantly from the plant height of local maize intercropped with soyabean and local maize intercropped with groundnut. However, the data show that J0-98 intercropped with groundnut was teller than all other treaments.(Table 7)

The effect of nitrogen rate on the height of maize plant at date of first *Striga* emergence was significant, plant height was taller at 100kgN/ha than 0kg N/ha (Table 8).

Effect of variety and intercropping on plant establishment at maturity were significant (Table 9). J0-98 intercropped with groundnut have the highest plant establishment followed by J0-98 intercropped with soyabean. J0-98 maize only established better than local maize only and local variety intercropped with either soyabean or groundnut. However there was significant effect of intercropping on dry weight of maize plant production at maturity when J0-98 resistant variety was intercropped with soyabean and groundnut while local maize intercropped with groundnut was very low.

Table 7: Effect of intercropping on days to 50% tasselling and height of maize plant at date of first *striga* emergence (cm)

Intercropping	Days to 50% tasselling	Plant height of first *striga* emergence
Maize only (J0-98)	**30.0**	**84.2**
Maize only (Local)	**37.0**	**60.7**
J0-98 + Soyabean	**31.0**	**92.4**
Local +Soyabean	**34.0**	**65.7**
J0-98 + groundnut	**30.0**	**99.5**
Local + Groundnut	**32.0**	**68.0**
F-L.S.D	**3.8**	**10.6**

Table 8: Effect of Nitrogen rate and variety on days to 50% tasselling and height of maize plant (cm) at date of first *striga* emergence.

Nitrogen rate ($kgNha^{-1}$)	Days to 50% tasselling	Plant height of first *striga* emergence
1	**33.2**	**79.5**
50	**32.4**	**87.3**
100	**30.3**	**101.1**
F-L.S.D	**-**	**9.64**

Table 9: Effect of variety and intercropping on maize plant establishment at maturity and dry weight of whole maize plant production (g) at maturity.

Intercropping	Maize plant at maturity	Mean	Dry weight of whole plant production at maturity (g)	Mean
Maize only (J0-98)	51.2	49.3	96.1	87.7
Maize only (Local)	47.4		79.2	
J0-98 + Soyabean	58.2	54.0	103.4	94.7
Local +Soyabean	49.1		86.0	
J0-98 + groundnut	61.0	54.6	98.1	71.1
Local + Groundnut	48.2		44.0	
F-L.S.D	7.2		34.2	

Table 10 shows that grain yield per plant was higher at 100kgN/ha compared to 0kgN/ha. The local susceptible variety yielded better at 50 and 100kgN/a than the J0-98 resistant variety at 0kgN/ha.
The effect of N-rate on 1000 seed weight of maize was significant. The seed weight was higher at 100kgN/ha compared to 0kgN/ha and 50kgN/ha other parameters taken did not show significant difference and are not discussed.

Table 10: Effect of variety and N-rate on the grain yield of Maize/Plant (g)

Nitrogen (kgNha-1)	Maize Variety		
	J0-98	Local	Mean
0	8.2	5.9	7.1
50	14.5	10.4	12.5
100	17.2	12.7	15.0
F-L.S.D	13.3	9.7	-

F-L.S.D (0.01) for comparing variety (V) means = 3.0
F-L.S.D (0.01) for comparing intercropping (I) means = 3.5
F-L.S.D (0.01) for comparing V x I interaction = 5.2

Table 11: Effect of variety and N-rate on 1000 seed weight of maize (g)

Nitrogen ($kgNha^{-1}$)	Maize Variety		
	J0-98	Local	Mean
0	83.2	65.4	74.3
50	110.0	79.6	94.8
100	149.9	89.7	119.8
F-L.S.D	114.4	78.2	-

F-L.S.D (0.01) for comparing variety (V) means = 34.2
F-L.S.D (0.01) for comparing intercropping (I) means = 41.3
F-L.S.D (0.01) for comparing V x I interaction = 62.4

IV. DISCUSSION

The ability of the resistant variety J0-98 intercropping with groundnut to consistently delay S.*hermonthica* than J0-98 and local maize only and local maize intercropped with soyabean could be due to the natural tolerance in the J0-98 resistant variety (Ast et al., 2000). Combination with the covering effect of groundnut which would increase the humidity of the soil and lower the temperature hence reduce transpiration and supply of nutrition from the maize to *Striga*, this is in agreement with the funding of Oswald et al., (1999).
The high Nitrogen rate (100kg N/ha) reduction of days from sowing to *Striga* emergence compared to 0 and 50kgN/ha could be as a result of physiological changes in the host plant as well as indirect effect by reducing soil temperature through greater shading (Parker, 1991). Dogget (1965) also reported that low soil fertility, particularly low nitrogen status thus is conducive to *Striga* parasitism, Isah (2002) also observed that in split application of compound fertilizer where 20kgN/ha was applied during planting, a delayed in a single emergence was observed with higher crop vigour although suppported higher *Striga* shoot count at later stage of the crop development. The above reason could be responsible for the reduced *Striga* infestation in 100N/ha compared to 0 and 50kgN/ha.

The taller plant height of maize plant at date of *Striga* emergence observed in J0-98 intercropped with groundnut could be explained by the delayed in the onset of *Striga* haustorium attachment to the host maize root, this is in agreement with the findings of Rodenburg et al., (2006) found that host crop resistance played an important role in *Striga* reproduction by reducing it by 70-93% compared with the susceptible ones, the

suppression of the *Striga* by shadding in intercropped is another reason for plant taller height (Oswald et al., 1999).

The higher plant height at high nitrogen rate at date of first *Striga* emergence could be due to the gain made by the maize plant as a result of the effect of nitrogen fertilization as explained earlier above.

The high maize plant establishment in J0-98 maize intercropped with soyabean and groundnut compared to J0-98 and local maize only at maturity, the high dry weight of whole maize plant production at maturity in the above treatment could be due to the effect of the reduction in the density of emerged *Striga* plant in intercropping and suppression of *Striga* shoot giving the maize a better change to established and hence yie lded well. This is in agreement with the work of Carson (1989). Hess and Dodo (2003) also gave similar report that emerged *Striga* numbers and *Striga* fruiting were strongly reduced on pearl millet intercropped with sasame compared to sole millet.

The high grain yield and 1000 seed weight at 100kgNha compared to 0 and 50kgN/ha is due to the beneficial effect of nitrogen to maize against the parasite *Striga hermonthica* as explained earlier above.

The correlation analysis showed that both the growth and grain yield of the local susceptible maize variety were move adversely affected by *Striga* than the resistant variety J0-98, this is in agreement with the finding of Van Ast et al (2000).

V. CONCLUSION

Integrated *Striga* management is more important in controlling *Striga* problem, resistant varieties are strongly recommended for sowing in *Striga* infested field for enhanced crop yield. Furthermore, high nitrogen fertilizer rate is beneficial if farmer can afford it.

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