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Intercrop Combination and Tillage Practice On Weed Cover Score And Weed Dry Weight In Maize / Groundnut Mixture In Anyigba, Kogi State, Nigeria

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ABSTRACT

There is no reliable study of worldwide damage due to weeds. However, it is widely known that losses caused by weeds have exceeded the losses from any category of agricultural pests such as insects, nematodes, diseases. Trials were conducted in the rainy seasons of 2020 and 2021, at Latitude 70 301 and Longitude 70 091 E in the Southern Guinea Savannah agro-ecological zone of Nigeria to evaluate the effect of tillage practice and crop combination on weed incidence. The treatment consisted of five intercropping patterns and three tillage practices in a factorial experiment (tillage practices and intercropping pattern) assigned in a Randomized Complete Block Design with four replications. Analyzed data at 3WAP, 6WAP and 6WAP show a significant ($p \leq 0.05$) effect of intercrop combination on Weed Cover Score in the 2021 cropping season though no such significance was observed in the 2020 season. Analyzed data also show a significant ($p \leq 0.05$) effect of planting pattern on weed dry weight in the 2021 cropping season though no such significance was observed in the 2020 season. Regarding tillage practice, non-significant ($p \geq 0.05$) effects of tillage practice on weed dry weight were observed in the 2020 cropping season, which was also at variance with the significant ($p \leq 0.05$) effect of tillage practice observed on weed dry weight in 2021 season. For both seasons, there were consistencies in the outcomes, with the highest weed dry weight observed in the Zero tillage followed by seeding on the flat and lastly when seeds were sown on ridges. Unless mitigated the highest crop losses should be expected on Zero tillage plots with the least when seeds are sown on ridges.

INTRODUCTION

In sub-Sahara Africa, about 70% of farmers are smallholders accounting for 90 percent of the total farm output characterized by poor yields arising from production constraints such as diseases, pests, and weeds (Cadini and Angelucci, 2013; Oyewole and Ibikunle, 2010; Oyewole et al. 2012). Of all the constraints weed competition is the most critical that poses the greatest problems on traditional arable crops, thus threatening food security in the sub-region (Dixit et al., 2008; Oyewole and Ibikunle, 2010; Oyewole et al. 2012). The economic losses due to weed competition are now recognized as major obstacles in maize production. More so, maize being a sensitive crop is highly vulnerable to weed infestation particularly during the first four weeks of its life hence varying degrees of percentage reductions caused by weed interference have been reported in the crop (Adigun and Lagoke, 1999). For instance; uncontrolled weed growth in pure maize fields has led to about 60 to 65% and 40 to 60% suppression in the overall grain yields of the crop from different ecological zones of Nigeria (Badmus et al. 2006).

Weed management is the most challenging component of maize production. Successful weed control is important for achieving maximum yield in maize grain and silage crops. Weeds that are not controlled compete for light and the crop's nutrient and water resources, and yield losses may be up to 70% of the potential yield. Although many maize farmers have developed successful management practices for weed control there are instances when weeds become a problem. These include times when herbicide use fails because of environmental conditions, weeds become resistant to recommended herbicides or the crop is being grown on leased land where weed control has been poor in the past. Effective weed control in maize requires attention to detail. If weeds get away there are immediate and ongoing losses for the maize grower (FAR Focus, 2013). The critical time for weed control in maize is between crop emergence and canopy closure. Weeds may emerge at any time during this period but are more likely to appear after rain. Successful weed management depends firstly on knowing what you are trying to manage. This may not be as easy as it sounds as most weed management practices depend on an early strike at the weed, when it has just two to four leaves. At this growth stage, all weeds may look similar, especially grass weeds (FAR Focus, 2013).

Weeds affect everyone in the world by reducing crop yield and crop quality, delaying or interfering with harvesting, interfering with animal feeding (including poisoning), reducing animal health, preventing water flow, as plant parasites, among others. Weeds are common everywhere and cause crop losses annually, with the global cost of controlling weeds running into billions of dollars (Kraehmer and Baur, 2013). The potential crop yield loss without weed control was estimated at 43% on a global scale (Oerke, 2006). While, (Rao, 2000) has reported that, of the total annual loss of agricultural produce from various pests, weeds account for 43%, insects 30%, diseases 20%, and other pests 5%. Annual worldwide losses to weeds were estimated to comprise approximately 10-15% of attainable production among the principal food sources. Reduction in crop yield has a direct correlation with weed competition. Weeds are the most acute pest in agriculture with an estimated annual global damage of around 40 billion dollars per year (Monaco et al. 2002). Generally, an increase in one kilogram of weed growth corresponds to a reduction in one kilogram of crop growth (Rao, 2000).

The yield of maize obtained in Nigeria is far below expectation due to numerous factors which include weed infestation, low soil fertility and availability of labor. Yield losses of between 60–80% have been attributed to uncontrolled weed infestation in maize (Lagoke et al. 1998) and this finding was confirmed by (Imoloame and Omolaiye, 2016), who reported 89% yield loss in maize as a result of uncontrolled weed infestation. Weed infestation is of supreme importance among biotic factors that are responsible for low maize grain yield. Worldwide maize production is hampered up to 40% by competition from weeds which are the most important pest group of this crop (Chikoye et al. 2004).

Also, the main problems limiting the production of groundnut are poor cultural practices and inadequate weed management. Weed causes much damage to the groundnut crop during the first 45 days of its growth. Reports have shown that groundnut cannot compete effectively with weeds, particularly 3-6 weeks after sowing. The average yield loss due to weed is about 30%; while at ICRISAT 100% yield loss has been observed. Therefore, early removal of weeds is important before flowering and during pegging (Page et al. 2002). If early weeding is done well, and crop spacing recommendations followed, then the weeds that come up later are smothered with the vigorous growth of the crop. Once flowering and pegging begin it is advisable to weed by hand pulling rather than by using hoe, as this is less likely to disturb any developing pods. Weed management rather than complete eradication of weed is the intent to regulate the population and maintain appropriate weed levels, taking into account both economic and ecological aspects that is, at a threshold level that does not cause economic loss to the crop and also does not adversely affect the environment (Harkansson, 2003).

The growth of groundnut is slow initially and the crop forms only a thin canopy offering little competition to most weeds at the stage (Zimdahl, 1980). Uncontrolled weed growth has been reported to cause a yield reduction of 50-80% in groundnut. Weed depresses groundnut yields by competing with the crop for light, minerals, and nutrients and also harvest operations. It is therefore important that weeds be controlled for profitable production (Brecke and Colvin 1991). With the increasing reports of negative environmental effects of continuous use of pesticides, the need to either totally eliminate or reduce its usage cannot be over-emphasized; an important key to this is the employment of agronomic practices, which may assist in achieving either reduction or elimination of pesticide utilization among farmers. The above justifies a study on cropping patterns and tillage practices on weed parameters in the study area.

The need to maximize land productivity in the humid tropics has become more evident (Steiner, 1991). This has not been achievable with monoculture with single harvests per season, as gains in production per unit area under this system have not been impressive in the tropical environment (IITA, 1990). Intercropping of two or more crops especially the family Poaceae with Fabaceae is popular in many countries because yields are often higher than pure cropping systems (Lithourgidis et al. 2006).

Tillage is crucial for crop establishment, growth, and ultimately, yield (Atkinson et al. 2007). A good soil management program protects the soil from water and wind erosion, provides a good, weed-free seedbed for planting, destroys hardpans or compacted layers that may limit root development, and allows maintenance or even an increase of organic matter (Wright et al., 2008). Many farmers perform tillage operations without being aware of the effect of these operations on soil physical properties and crop responses (Ozpinar and Isik, 2004). Poor crop establishment and low soil fertility are particularly constraining for crop production. Tillage practice is therefore key as cultivation implements impose varying degrees of alterations to both the surface soil and sub-soil. As such it is crucial to determine the best practice for tillage practices to maximize crop establishment and yield.

MATERIALS AND METHODS

Trial was conducted in the rainy seasons of 2020 and 2021 in Latitude 70 301 and Longitude 70 091 E in the Southern Guinea Savannah agro-ecological zone of Nigeria. The experiment sited at the Kogi State University Anyigba Students' Research and Demonstration Farm consisted of five intercropping patterns Sole Maize, Sole Groundnut, Two rows of maize and one row of groundnut, Two rows of groundnut and one row of maize, One row of maize and one row of groundnut and three tillage practice methods (planting on ridge, planting on flat land and zero tillage). Factorial combinations of the treatments (tillage practice and intercropping pattern) fully randomized were laid out in a Randomized Complete Block Design with four replications. Plot size measuring 3m x 4.5m (sixty plots) were used for the experiment.

For the tillage practice involving planting seeds on the flat, the land was ploughed, harrowed and made into flat beds, while for those crops sown on the ridge, the experimental site was ploughed, harrowed and ridged 75cm apart while for the zero tillage, conventional tillage practices were not done before seed sowing. Factorial combinations of these treatments (tillage practice and intercropping pattern) fully randomized were laid out in a Randomized Complete Block Design with four replications. Plot sizes measuring 3m x 4.5m (sixty plots) were used for the experiment.

One improved variety of maize (TZESR) and one local variety of groundnuts (Angba-chido) obtained from IITA – Ibadan and ADP Anyigba, Kogi state, respectively were used. Row replacement methods were employed in seeding the groundnut plots; moving from sole cropped plots, which were then gradually replaced with rows of maize until attaining sole maize plots. While the groundnut stands were seeded 23 cm x 75 cm, the maize stands were seeded 25 cm x 75 cm. Two seeds of groundnut as well as maize were planted per hole, which were thinned to one seedling per stand at two weeks after planting (2 WAP). NPK 15:15:15 was applied to all the plots as the basal application (45kg N/ha, 45kg P2O5 and 45kg K2O/ha) and top dressed with Urea at 6 WAP. Percentage seedling emergence was determined ones at two weeks after planting (2 WAP).

Average of three quadrant throws were used in the determination of weed parameters (weed floral, weed cover score, weed biomass) at 3, 6 and 9 WAP after cropping. For weed dry weight samples within the quadrant throws were oven dried at 750C for 48 hours allowed to cool before weighing using the Metler Toledo electric weighing scale. For Weed Cover Score, a scale of 1 - 9, was used where 1 was complete absence of weeds, and 9 was complete coverage of the plot by weeds. All weed data were transformed using the square root transformation method before analysis.

RESULTS AND DISCUSSION

Effect of Planting Pattern, Tillage Practice and Their Interactions on Weed Cover Score:

Weed infestation is reported to be of supreme importance among biotic factors that are responsible for low maize and groundnut yields (Selvakumar and Sundari, 2006). Analyzed data at weeks 3, 6, and 9 show a significant ($p \leq 0.05$) effect of intercrop combination on Weed Cover Scores in the 2021 cropping season though no such significance ($p \geq 0.05$) was observed in the 2020 season (Table 1) at week 3, 6 and 9. The significant effect of intercrop on Weed Cover Score in the 2021 cropping season, is similar to the observation made by Rao (2000) and Hamzei. and Seyedi (2015), of the significant effect of intercropping on weed suppression in maize, but Rao (2000) emphasizes that intercropping system alone is not sufficient to ensure adequate weed management practices, because of varied canopy coverage occurrence among the intercrops. The variation in observation between seasons is in line with Oyewole (2004) who observed that research outcomes could vary between seasons due to various factors, such as weather, pests, and agronomic factors, among other reasons. In both cropping seasons, among sole crops, sole maize performed better than sole groundnut in reducing Weed Cover Score, thus lowered Weed Cover Scores were consistently observed in sole maize when compared with sole groundnut (Table 1). The observation is understandable, noting that maize, as an erect and taller crop, should be better at shading than the crawling groundnut (Oyewole, 2004). In the 2020 and 2021 cropping seasons, the more the inclusion of maize stands among the intercrops, the more the reduction in Weed Cover Scores (Table 1), which could translate into an increase in yield as observed by Oyewole, et.al. (2016), who noted that observed reduction in Weed Cover Scores is likely to affect the competitive ability of the associating weeds negatively.

Table 1: Effect of planting pattern, tillage practice, and their interactions on Weed Cover Score

Treatment	Weed cover score (Scale of 1 - 9)						
	2020				2021		
	3 WAP	6 WAP	9 WAP		3 WAP	6 WAP	9 WAP
Intercrop Combination							
Sole maize	1.40^{a}	1.43^{a}	1.38^{a}		2.75^{ab}	3.23^{a}	3.62^{a}
Sole groundnut	1.58^{a}	1.62^{a}	1.49^{a}		3.00^{a}	3.49^{a}	3.85^{a}
2maize:1g/nut	1.52^{a}	1.58^{a}	1.45^{a}		2.25^{c}	2.58^{b}	2.63^{b}
2g/nut:1maize	1.69^{a}	1.69^{a}	1.52^{a}		2.38^{bc}	2.66^{b}	2.72^{b}
1maize:1g/nut	1.54^{a}	1.59^{a}	1.52^{a}		2.42^{bc}	2.59^{b}	2.70^{b}
LSD (0.05)	0.43ns	0.43ns	0.19ns		0.37*	0.27*	0.37*
Tillage (T)							
Ridge	1.42^{a}	1.46^{a}	1.43^{a}		2.23^{b}	2.63^{b}	2.93^{b}
Flat	1.52^{a}	1.51^{a}	1.53^{a}		2.28^{b}	2.84^{b}	2.94^{b}
Zero Tillage	1.70^{a}	1.78^{a}	1.47^{a}		3.18^{a}	3.26^{a}	3.45^{a}
LSD (0.05)	0.33 ns	0.33 ns	0.15 ns		0.28*	0.21*	0.28*
Interaction							
P x T	ns	ns	ns		ns	ns	ns
C.V %	13.70	13.2	15.1		17.4	11.1	14.3

As par tillage practice, data collected at week 3, 6 and 9 indicate non-significant ($p \geq 0.05$) effect of tillage practice on Weed Cover Scores in 2020 cropping season, which was at variance with the significant ($p \leq 0.05$) effect of tillage practice observed in 2021 season (Table 1) within the same period. In both seasons, there were consistencies in the outcomes among tillage practice, with the highest Weed Cover Scores observed in the Zero tillage followed by seeding on the flat and lastly when seeds were sown on ridges; even where such were not statistically significant, such as in 2020 cropping season. No significant interactions were observed between intercrop combination and tillage practice on Weed Cover Scores at 3WAP, 6WAP, and 9WAP in the 2020 and 2021 cropping seasons. Generally, tillage practice played a significant role in moderating Weed Cover Scores, where Zero tillage encouraged higher Weed Cover Scores in both seasons. Since the reduction in crop yield has a direct correlation with weeds, to mitigate their effects where Zero tillage is practiced, there may be the need for some form of weed control mechanisms, such as the use of herbicides. With a Weed Cover Score range between 1 – 9, where 1 was an indication of a plot devoid of weeds, a score of 9 for a plot completely covered by weeds, the least score observed in the 2020 cropping season was 1.39 while the highest Weed Cover Score was 1.69. In the 2021 season, the least Weed Cover Score was 2.25 while the highest Weed Cover Score was 3.85. With Weed Cover Scores ranging between 1.39 and 3.85 across seasons, was an indication of plots either almost weed-free to plots about 1/3 covered by weeds.

Table 2: Effect of planting pattern, tillage practice, and their interactions on Weed dry weight (g/m2) in 2020 and 2021 cropping season

Treatment	Weed dry weight (g/m^2)					
	2020			2021		
	3 WAP	6 WAP	9 WAP	3 WAP	6 WAP	9 WAP
Intercrop Combination						
Sole maize	20.66^a	20.66^a	9.85^a	27.26^a	21.79^a	13.85^a
Sole groundnut	18.25^a	18.19^a	9.92^a	27.06^a	20.53^{ab}	13.12^a
2maize:1g/nut	19.61^a	19.47^a	9.70^a	22.69^b	18.20^b	11.62^b
2g/nut:1maize	20.16^a	20.13^a	9.99^a	23.15^b	18.36^b	12.83^{ab}
1maize:1g/nut	20.00^a	19.74^a	9.11^a	20.90^b	17.85^b	12.73^{ab}
LSD	3.23ns	3.47ns	1.20ns	2.73*	3.27*	1.82*
Tillage (T)						
Ridge	18.74^b	18.50^b	9.21^a	21.75^a	16.65^b	11.26^b
Flat	18.98^{ab}	18.9^{ab}	9.96^a	22.02^b	17.45^b	11.69^b
Zero Tillage	21.48^a	21.51^a	9.98^a	28.86^a	23.94^a	15.53^a
LSD	**2.50***	**2.70***	**0.93ns**	**2.12***	**2.53***	**1.41***
Interaction						
P x T	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**
C.V %	19.8	21.5	15.0	13.7	20.5	17.2

Effect of Intercrop Combination, Tillage Practice, and Their Interactions on Weed Dry Weight

Analyzed data show a significant (p ≤ 0.05) effect of planting pattern on weed dry weight in the 2021 cropping season though no such significance was observed in the 2020 season (Table 2). Regarding tillage practice, non-significant (p≥0.05) effects of tillage practice on weed dry weight were observed in the 2020 cropping season, which was also at variance with the significant (p≤0.05) effect of tillage practice observed on weed dry weight in the 2021 season. For both seasons, there were consistencies in the outcomes, with the highest weed dry weight observed in the Zero tillage followed by seeding on the flat and lastly when seeds were sown on ridges. Unless mitigated, the highest crop losses should be expected on Zero tillage plots with the least where seeds were sown on ridges. The report has shown that an increase of one kilogram of weed growth corresponds to a reduction in one kilogram of crop growth (Rao, 2000). No significant interactions were observed between intercrop combination and tillage practice on weed dry weight at 3WAP, 6WAP, and 9WAP in the 2020 and 2021 cropping seasons.

Effect of Intercrop Combination, tillage practice, and their interactions on Maize and groundnut yields in 2020 and 2021 cropping seasons:

Generally, crops have been grown under conventional agricultural practices in Nigeria for years (Antenyi, 2021). The basis for conventional tillage is annual ploughing or tilling of the soil, but this is usually supplemented with a number of other practices, including the removal or burning of crop residues, land leveling, harrowing, fertilizer application, and incorporation; all of these practices cause soil disturbance, compaction, and deterioration, with anticipated effects on crop yields (Antenyi, 2021).

Table 3: Effect of Intercrop Combination, tillage practice, and their interactions on maize cob weight and seeds/cob in the 2020 and 2021 cropping season

Treatment	2020 cropping season				2021 cropping season			
	Cob Weight (t/ha)	Seeds / cob	Grain Yield (t/ha)	Land Equivalent Ratio	Cob Weight (t/ha)	Seeds / cob	Grain Yield (t/ha)	Land Equivalent Ratio
Intercrop Combination								
Sole maize	207.33^{a}	316.25^{a}	2.37^{a}	-	954.32^{a}	2492.33^{a}	5.95^{a}	
2maize:1g/nut	107.59^{b}	256.75^{b}	1.57^{b}	1.28	437.65^{c}	1133.50^{b}	4.54^{b}	1.19
2g/nut:1maize	108.67^{b}	254.83^{b}	1.70^{b}	1.29	472.22^{b}	1199.25^{b}	4.77^{b}	1.28
1maize:1g/nut	103.27^{b}	271.17^{b}	1.70^{b}	1.38	481.48^{b}	1205.42^{b}	4.65^{b}	1.32
LSD	23.527*	51.000*	0.44*	-	32.660*	271.050*	0.346*	
Tillage (T)								
Ridge	87.51^{a}	216.05^{a}	1.37^{a}	1.06	414.44^{c}	1026.65^{b}	3.88^{a}	1.38
Flat	101.19^{a}	223.80^{a}	1.53^{a}	1.25	515.19^{a}	1434.95^{a}	4.08^{a}	1.40
Zero Tillage	95.07^{a}	219.55^{a}	1.51^{a}	1.28	477.78^{b}	1156.70^{b}	3.99^{a}	1.42
LSD	33.715ns	39.510ns	0.344ns		22.757*	209.951*	0.265ns	
Interaction								
P x T	**ns**	**ns**	*		*	*	*	
C.V %	21.4	28.2	26.0		25.4	27.3	10.3	

Maize (Table 3), Stover yield responded significantly to intercrop combination as well as tillage practice in both cropping seasons. However, 100-seed weight was not significantly (P≥0.05) influenced by intercrop combination, tillage practice, or their interactions in both cropping seasons. Planting maize seeds on the flat gave the best grain yield, with maize seeds planted on ridges giving the lowest grain yield in both seasons.

On the groundnut component of the mixture (Table 4), Haulm yield/ha, pod yield/ha, harvest Index (HI), and shelling percentage responded significantly to intercrop combination in both cropping seasons, while 100-seed weight responded to intercrop combination only in 2021 cropping season. No significant effect of tillage practice was observed on all parameters taken nor were there significant interactions between intercrop combination and tillage practice on the investigated parameters; an indication that tillage was not a necessary treatment in groundnut cultivation in the study area. Relative to LER, among intercrop combination, the highest LER were observed when one row of maize was intercropped with one row of groundnut, with the least LER observed when two rows of maize were intercropped with one row of groundnut. This was similar to observations made by Oyewole (2004), in a millet/groundnut intercrop in the Sudan savanna ecological zone; where he observed that intercropping was generally advantageous when compared with sole cropping. Also, the observation was similar to the findings by Antenyi (2021), where intercropping was observed to be better than sole cropping in a maize/cassava intercrop. Finally, among the tillage practice, zero tillage gave the highest LER with planting on ridges giving the least LER. Intercropping was generally advantageous, an observation that was in line with Oyewole (2004), Selvakumar and Sundari (2006), and Hamzei. and Seyedi (2015).

Table 4: Effect of Intercrop Combination, tillage practice, and their interactions on days to flowering and yield-related parameters in 2020 and 2021 cropping seasons

Treatment	Days to Flowering		Haulm Yield (kg/ha)		Pod yield (kg/ha)		Harvest Index (%)		100-seed weight (g)		Shelling %	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Intercrop Combination												
Sole groundnut	32.67 ^{a}	26.83 ^{a}	711.11^{a}	637.04^{a}	1532^{a}	1367^{a}	53.26^{a}	36.74^{a}	47.83 ^{a}	48.32^{a}	61.00^{a}	79.42^{a}
2maize:1g/nut	34.17 ^{a}	28.17 ^{a}	355.56^{b}	289.89^{b}	1283^{c}	1226^{b}	28.32^{c}	22.64^{b}	44.83 ^{a}	39.76^{b}	53.17^{b}	60.65^{b}
2g/nut:1maize	33.25 ^{a}	27.67 ^{a}	362.96^{b}	266.67^{b}	1332^{b}	1234^{b}	33.23^{bc}	23.48^{b}	44.83 ^{a}	38.55^{b}	54.20^{b}	54.18^{b}
1maize:1g/nut	33.33 ^{a}	28.83 ^{a}	377.78^{b}	266.67^{b}	1384^{b}	1221^{b}	38.44^{b}	22.14^{b}	44.83 ^{a}	38.79^{b}	55.19^{b}	54.96^{b}
LSD (0.05)	1.600ns	2.830 ns	77.120*	66.100*	70.6*	27.8*	7.060*	2.780*	4.000ns	4.980*	5.080*	6.500*
Tillage (T)												
Ridge	27.50 ^{a}	22.40 ^{a}	311.11 ^{a}	310.11 ^{a}	1276 ^{a}	1212 ^{a}	27.67 ^{a}	21.24 ^{a}	35.80 ^{a}	31.59 ^{a}	43.47 ^{a}	49.56 ^{a}
Flat	26.35 ^{a}	22.10 ^{a}	377.78 ^{a}	288.89 ^{a}	1322 ^{a}	1204 ^{a}	32.20 ^{a}	20.42 ^{a}	36.70 ^{a}	32.19 ^{a}	44.55 ^{a}	51.23 ^{a}
Zero Tillage	26.20 ^{a}	22.40 ^{a}	378.78 ^{a}	288.89 ^{a}	1320 ^{a}	1213 ^{a}	32.08 ^{a}	21.34 ^{a}	36.90 ^{a}	35.48 ^{a}	46.12 ^{a}	48.74 ^{a}
LSD (0.05)	1.240ns	0.640ns	67.900ns	78.790ns	54.7ns	21.5ns	5.470ns	2.150ns	3.100ns	3.860ns	3.940ns	5.040ns
Interaction												
P x T	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
C.V %	7.3	4.5	28.9	31.1	27.9	16.1	27.9	16.1	13.3	18.3	13.8	15.8

CONCLUSION

Weed management is the most challenging component of maize production. Successful weed control is important for achieving maximum yield in maize grain and silage crops. Weeds that are not controlled compete for light and the crop's nutrient and water resources, and yield losses may be up to 70% of the potential yield. Although many maize farmers have developed successful management practices for weed control there are instances when weeds become a problem. For both seasons, there were consistencies in the outcomes, with the highest weed dry weight observed in the Zero tillage followed by seeding on the flat and lastly when seeds were sown on ridges. Thus, unless mitigated the highest crop losses should be expected on Zero tillage plots with the least when seeds are sown on ridges. Intercropping was generally advantageous compared with sole cropping, thus recommended for the experimental area. Generally, the inclusion of maize in the system had positive effect on both Weed Cover Scores as well as Weed Dry weight; as reductions in these parameters were observed. However, higher maize population inclusion in the mixtures may give better results and should be encouraged.

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ANNEXURES

Rainfall Data For 2020

MONTHS	RAINFALL MONTHLY MEAN (mm)	MIN TEMP (^{o}C)	MAX TEMP (^{o}C)
JANUARY	0.0	19.6	23.8
FEBRUARY	0.0	20.6	26.5
MARCH	4.1	24.6	27.0
APRIL	1.7	25.1	27.7
MAY	3.6	24.5	27.0
JUNE	3.9	23.9	25.2
JULY	9.8	23.6	25.5
AUGUST	5.0	23.4	25.2
SEPTEMBER	6.1	23.5	24.4
OCTOBER	11.1	25.4	26.2
NOVEMBER	0.52	25.3	27.8
DECEMBER	0.00	20.5	25.3