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The effects of different tillage practices on soil properties, yield and pest incidence of various sweet corn (*Zea mays* L. Var Saccharata) varieties

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ABSTRACT

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Conservation tillage is one of the crop production adaptation strategies for conserving soil and mitigating climate change. This study aimed to evaluate the effects of different tillage practices on the yield, soil properties, and pest incidence of corn varieties that would give optimum output. The experiment was laid out in a split-plot arranged in a randomized complete block design with three replications. Zero and minimum tillage served as the main plot, and the different sweet corn varieties as the subplot (T_1-Macho F1, T_2-Sweet Supreme F1, T_3-Purple Magic F1, T_4-Hi-Brix XL F1, and T_5-Sugar King F1). Results showed that Hi-Brix XL F1 (8t ha^{-1}), Purple Magic F1 (7.44t ha^{-1}), and Macho F1 (7.45t ha^{-1}) obtained high marketable ear yields among the different sweet corn varieties. On the other hand, zero and minimum tillage did not vary significantly in terms of the soil properties, resulting in no yield advantage for sweet corn. This means that sweet corn production can be done either with zero or minimum tillage. In addition, zero tillage practice obtained lower fresh weight (g) of weeds at 15 and 45 days after planting. Weeds were eliminated using non-selective herbicide spray with zero tillage, resulting in lower weed incidence than with minimum tillage where only one plowing and harrowing were done.

Keywords: Conservation tillage, sweet corn varieties, and yield performance

INTRODUCTION

Sweet corn, also called sugar corn and pole corn is an excellent, low-starch variety with a high sucrose content (18%) of the dry weight (USDA 2018). Nowadays, the quantity of sweet corn sold in the Philippines in 2020 was 25 tons. In 2019 the

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demand for sweet corn was increasing due to its good taste, and suitability as a snack item. In the Philippines alone, 45 tons of sweet corn were sold (selinawamucii.com, retrieved July 20, 2022). Thus, sweet corn production is preferred by some Filipino farmers to increase their income and meet the Philippine market demand. However, sweet corn production is affected by the impact of climate change. According to Hirich et al (2016), crop evapotranspiration is expected to increase by 15% with an increasing temperature of 3.0^{0}C, while crop water requirements are expected to decrease by 13% due to the shortening of the growth season of corn by 20 days. Crop productivity could reduce by 2.5% towards the end of the twenty-first century. Conservation tillage practices such as zero and minimum tillage are keys to maintaining the productivity of sweet corn production (Piccoli et al 2016).

Zero tillage is a way of growing crops wherein the soil is not plowed or harrowed. In contrast, minimum tillage involves considerable soil disturbance, yet to a much lesser extent than conventional tillage. These practices lead to positive changes in the soil's physical, chemical, and biological properties (Bescansa et al 2006). Bhatia et al (2010) reported that no-tillage in the upland ecosystem increased bulk density and water-filled pore space, which resulted in increased oxygen availability and higher N_2O emissions, thus increases the global warming. Farkas et al (2009) reported that moisture content was higher in the no-tillage system in the top layer 0-20cm than the conventional tillage method. Likewise, minimum tillage had higher bulk density and aggregate stability than traditional tillage in silty loam soil. At the same time, moisture content was increased throughout the silty loam soil and heavy loamy sand soil (Josa et al 2010). Researchers observed an increase of soil organic matter (SOM) and carbon (SOC) in the topsoil layer with conservation tillage practices (Powlson et al 2012). According to Spiegel (2007), there was an accumulation of considerable nitrogen (N), phosphorus (P), and potassium (K) with conservation tillage.

A zero tillage or no-till system is the most effective practice in conserving soil moisture among other tillage systems, especially during dry periods in rain-fed agricultural areas (Al-Kaisi et al 2012). Conserved soil had higher available nutrients due to lower nutrient losses and improved soil physical, chemical, and biological properties leading to increased crop yield. Likewise, conservation or zero tillage reduces weed incidence. According to Sharma et al (2004), zero tillage conserved soil moisture and reduced weed infestation compared to conventional tillage.

Another essential factor to consider in sweet corn production is variety. It is crucial to select a cultivar with disease and insect pest-resistant qualities as well as early maturing characteristics that reduce the crop's exposure to adverse conditions brought about by climate change. Furthermore, cultivars differ in their performance across environmental conditions. Information about sweet corn varieties under different tillage practices is minimal. Therefore, this study was conducted to evaluate the effects of different tillage practices on the yield, soil properties, and pest incidence in sweet corn as well as identify suitable sweet corn varieties that would give optimum yield.

MATERIALS AND METHODS

The study was conducted at the experimental area of the Department of Agronomy, Visayas State University, Visca, Baybay City, Leyte, from January 15, 2020, to April 7, 2020. For zero tillage (M_1) no plowing and harrowing were done. It was sprayed with non-selective (glyphosate) herbicide to eliminate the weeds. Simultaneously, plots for minimum tillage (M_2) were plowed and harrowed once with a four-wheeled tractor. After harrowing, furrows were made 0.75m apart.

Experimental Design and Treatments

The experiment was laid out in a split-plot arranged in a randomized complete block design (RCBD) with three replications. Tillage practices served as the main plot (M_1-Zero tillage and M_2-Minimum tillage), and the different sweet corn varieties as the subplot (T_1-Macho F1, T_2-Sweet Supreme F1, T_3-Purple Magic F1, T_4-Hi-Brix XL F1, and T5-Sugar King F1). Each plot measured 4x4.5m (18m^2) each. Alleyways of 1m between replication and 1m between treatment plots were provided to facilitate farm operations and data gathering. Minimum and Zero tillage were managed through blocking, separating the Minimum and Zero tillage practices for easy preparation.

Cultural Management Practices

The different sweet corn seeds were sown in a seedling tray to ensure a high germination percentage. One (1) seed was planted in each cell of the seedling tray, covered with a thin layer of soil, and placed in a shaded area. Watering was done during and every other day after sowing until the seedlings were ready for transplanting (7 days after sowing). A general recommended fertilizer rate (Corn and Sorghum Technical Working Group 2017) of 120-60-60kg ha^{-1} N, P_2O_5, K_2O for sweet corn was followed. Basal application of complete fertilizer of 60kg ha^{-1} N, P_2O_5, K_2O was done by drilling the fertilizer along the rows covered with a thin layer of soil one day before transplanting. The remaining 60kg ha^{-1} N requirement was satisfied using urea side-dressed 21 days after sowing. Only one (1) seedling per hill was planted in the designated plots at a distance of 0.75m between rows and 0.25m between hills.

Weeds were controlled by hand weeding at 15 and 40 DAT after gathering the weed data. For rodents, a ready-made bait was mixed with rice and dried fish. The ready-made bait was placed inside bamboo pieces to protect it from heavy rains and was distributed around the area. At the same time, insect pest infestation was observed and recorded. Lambda-cyhalothrin was sprayed at the rate of 2 tablespoons per $16L^{-1}$ of water to control the pests. This was repeated three times from seedling emergence up to the tasseling stage of the corn. Monitoring of the experiment was performed daily to assess the presence of insect pest infestations.

Harvesting was done 70 days after sowing when the crop attained its green cob stage, when it formed its *dough* grain where the kernel interior was similar to a "dough." Corn silks had turned dry at this stage. All sample plants in the harvestable area (10.50m^2), excluding the border plants in each row, were harvested.

Data Gathered

The yield parameters gathered were the following: the number of marketable and non-marketable ears ha^{-1}, the weight of marketable and non-marketable ears (t ha^{-1}), and total ear yield (t ha^{-1}). For the chemical soil properties, soil pH using the Potentiometric Method of 1:2.5 soil-water ratio (ISRIC 1995), % organic matter by modified Walkley and Black method (Nelson and Sommers 1982), total N (%) using the Kjeldahl method (ISRIC 1995), available P by Modified Olsen Method (Olsen and Sommer 1982), and exchangeable K content by Ammonium Acetate Extraction Method (ISRIC 1995) were determined. After harvest, five soil samples were gathered per treatment plot and analyzed for organic matter. Available P. Total N was determined by multiplying OM by 0.05 since most organic matter in soil is on average about 5% N (Thakur et al 2012). Moreover, water holding capacity was determined by using the gravimetric method described by PCARR (1980). For weed data, two sample quadrats (50cmx50cm quadrat) per plot were used to identify prevalent weed species, weed incidence, and the fresh and dry weights of weeds. Insect pest incidence was assessed at 30 and 60 DAT based on the Corn and Sorghum Technical Working Group (2017).

Statistical Analysis

The analysis of variance (ANOVA) of all data was done using the Statistical Tool for Agricultural Research (STAR) version 2.0.1 2014. Honestly Significant Difference (HSD) was used for comparison among treatment means that showed significant differences.

RESULTS AND DISCUSSION

Meteorological Data

The total weekly rainfall, mean relative humidity and daily minimum and maximum temperature throughout the duration of the experiment were obtained from the records of the Philippine Atmospheric, Geophysical and Astronomical Service Administration (PAGASA) Station, VSU, Baybay City, Leyte (Table 1). The total amount of rainfall throughout the experimental period was 304.28mm. The average water consumption of sweet corn ranges from 500mm to 800mm throughout the growing period (FAO nd). It showed that the rainfall during the study period did not meet the water demand for sweet corn. Thus, irrigation was done during the conduct of the study. Maximum temperature range recorded was 28.16°C to 29.78°C while minimum temperature range was 23.69°C to 24.23°C which was favorable for the growth and development of sweet corn. According to the Corn and Sorghum Technical Working Group (2017) the optimum temperature requirement for normal growth and development of corn is 24 to 28°C. Likewise, relative humidity varied from 85.67-91.57% favoring normal growth and development.

Soil Chemical and Physical Properties

Tables 2 and 3 show the soil's chemical and physical properties one day before sowing and after the harvest of the different sweet corn varieties under zero and minimum tillage. Results revealed that the soil properties (chemical and physical) under both tillage practices and the different sweet corn varieties did not differ significantly. Initial soil test results of the chemical properties showed that the experimental area was moderately acidic (pH6.05), deficient in organic matter (1.50%), low in total N (0.08%) and available P (5.97mg kg^{-1}), and high exchangeable K (1.55me $100g^{-1}$) based on the indices of soil nutrient availability by Landon (1991).

Table 1. Total weekly rainfall (mm), minimum and maximum temperatures (°C), and relative humidity (%) throughout the duration of the study

Monthly	Period Covered	Total Rainfall (mm)	Temperature (°C)		Relative Humidity (%)
			Maximum	Minimum	
1	July	95.40	28.16	24.23	89.57
2	August	87.90	27.83	23.69	91.65
3	September	120.98	29.78	24.00	81.98
Total	-	304.28	-	-	-
Mean	-	-	28.59	23.97	87.73

Table 2. Chemical properties of the soil before and after harvest of different sweet corn varieties under zero and minimum tillage

Treatment	pH	OM (%)	Total N (%)	Available P (Mg Kg^{-1})
Initial Soil Analysis	6.045	1.500	0.075	5.972
Final Soil Analysis				
Conservation Tillage Practices				
M_1 = Zero Tillage	5.920	1.700	0.085	8.674
M_2 = Minimum Tillage	5.830	1.609	0.080	7.944
Sweet Corn Varieties				
T_1 = Macho F1	5.790	1.638	0.082	9.722
T_2 = Sweet Supreme F1	5.950	1.739	0.087	8.439
T_3 = Purple Magic F1	5.960	1.576	0.079	7.354
T_4 = Hi-Brix XL F1	5.930	1.691	0.085	8.338
T_5 = Sugar King F1	5.780	1.629	0.081	7.693
CV (a) %	2.490	9.640	10.000	11.810
CV (b) %	3.320	7.740	7.620	20.760

Means within a column followed by the same letter are not significantly different at the 5% level, HSD.

After harvest (70 days after sowing), all the soils' chemical parameters under the different tillage practices and soils planted with different sweet corn varieties had increased. This can be attributed to the proper cultural management practices done in the field, especially on the zero tillage where the soil was not disturbed, and nutrients in the soil were mineralized.

On the other hand, the value of total N had a direct relationship to the amount of organic matter in the soil (Nelson and Sommers 1982). The soil organic matter largely contributed to nutrient cycling and supplied other elements, including N (Saleque et al 2009). Available soil nitrogen ready for plant uptake depends on the rate of carbon mineralization. According to Wang et al (2008), in the initial years, no-tillage practice is generally associated with lower soil available nitrogen because of higher immobilization by the crop residues on the soil surface. Therefore, a slight increase in soil organic matter resulted in a rise in total N. In terms of a slight increase of available P. This was due to lower P losses resulting from lower erosion and P-containing fertilizer (complete fertilizer).

The soil physical properties are presented in Table 2. The result shows that the soil texture was sandy loam capable of quickly draining excess water but not holding a significant amount of water or nutrients (Thompson 2018). Neither conservation tillage practices nor sweet corn varieties significantly influenced bulk density at 0-20cm soil depth and water holding capacity. Likewise, the bulk density of the soil analyzed did not show any significant differences in the tillage practices employed and the different sweetcorn varieties planted in the area.

Table 3. Physical properties of the soil before planting and after harvest of different sweet corn varieties under zero and minimum tillage

Treatment	Bulk Density (GCm^{-3})		Water Holding Capacity (%)
	0-10cm	10-20cm	
Initial Soil Analysis	1.12	1.33	57.13
Final Soil Analysis			
Conservation Tillage Practices			
M_1 = Zero Tillage	1.12	1.11	61.38
M_2 = Minimum Tillage	1.05	1.11	61.01
Sweet Corn Varieties			
T_1 = Macho F1	1.10	1.11	63.15
T_2 = Sweet Supreme F1	1.12	1.10	59.18
T_3 = Purple Magic F1	1.15	1.15	61.91
T_4 = Hi-Brix XL F1	1.12	1.08	61.42
T_5 = Sugar King F1	0.94	1.11	60.32
CV (a) %	16.61	2.75	1.96
CV (b) %	17.60	8.49	5.74

Means within a column followed by the same letter are not significantly different at the 5% level, HSD.

Ear Yield

Table 4 shows the yield and yield components of different sweet corn varieties as influenced by conservation tillage practices. A significant difference was observed among sweet corn varieties regarding the number of non-marketable ears (ha^{-1}) and the weight of non-marketable ($t\ ha^{-1}$). However, all parameters of sweet corn were not significantly affected by the two tillage practices. On the other hand, conservation tillage practices did not vary significantly, and had similar results on the ear yield of sweet corn varieties. This indicates a no-yield benefit in the short-term approach of conservation tillage. However, Fowler and Rockström (2001) and Ito et al (2007) found a possible increase in long-term crop yields due to increased mulch retention, soil moisture, improved soil structure, and biotic activity.

Thus, adopting either of these two tillage practices can be done. Hi-Brix XL F1 (T4) obtained the highest marketable ears but comparable to Purple Magic F1 (T_3) and Macho F1 (T_1). Sugar King F1 (T_5) had the heaviest weight ($t\ ha^{-1}$) of non-marketable ears, and also produced the greatest number of non-marketable ears, thereby producing the lowest number of marketable ears. Purple Magic F1 (T_3) had the lightest weight (t ha^{-1}) of non-marketable due to lower pest damage of ears (Table 3); hence, it produces a higher value of marketable ears. This variety can be recommended to be planted in areas with higher pest incidence. The variation of the different varieties' performance was attributed to the varietal genotype characteristics since no soil advantage was recorded in terms of the nutrients and available water.

Table 4. Ear yield (t ha^{-1}) of sweet corn varieties as affected by conservation tillage practices

Treatment	No. of Ears (t ha^{-1})		Ear Yield (t ha^{-1})		Total Ear Yield (t ha^{-1})
	Marketable	Non-Marketable	Marketable	Non-Marketable	
Conservation Tillage Practices					
M_1 = Zero Tillage	28,504	15.552	6.47	2.35	9.92
M_2 = Minimum Tillage	34,095	11,428	8.06	1.80	10.70
F test	ns	ns	ns	ns	ns
Sweet Corn Varieties					
T_1 = Macho F1	31,904	13,809b	7.44ab	1.94b	10.46
T_2 = Sweet Supreme F1	30,314	13,971b	7.00b	2.39b	9.90
T_3 = Purple Magic F1	35,400	8,257c	7.45ab	1.05c	9.79
T_4 = Hi-Brix XL F1	31,590	13,495b	8.00 a	1.95b	10.84
T_5 = Sugar King F1	25,876	18,571a	6.32 c	3.05a	10.57
F test	ns	**	*	**	ns
CV (a) %	16.02	48.16	16.78	61.56	8.23
CV (b) %	21.49	23.34	23.91	19.79	13.59

Means within a column followed by the same letter are not significantly different at 5% level, HSD.

Weed Parameters

The degree of weed incidence at 15 and 40 DAT of sweet corn varieties under conservation tillage practices are presented in Table 5. Zero tillage at 15 DAT had a lighter incidence, while in 40 DAT, a heavy incidence was observed. Few weeds were observed in zero tillage at the early vegetative stage due to herbicide application one week before transplanting, but after more than two weeks, the weeds grew faster.

Table 6 shows the dominant weed species observed in the experimental area under the two tillage practices used in the study. The dominant weed species were *Ageratum conyzoides* L., *Rottboellia cochinchinensis* L., *Commelina diffusa* B., *Eleusine indica* L., *Cynodon dactylon* L., and *Cyperus rotundus* L. The weed group that had more species of weeds were grasses under minimum tillage. Zero tillage had only three weeds species without dominant broadleaves due to the effect of herbicide spray used and higher mortality of weed seeds on the soil's surface as seed predators (mice and insects) fed on some of these seeds. Less disturbance of soil restricts the movement of the seeds to their favorable environmental condition, which inhibited the germination of weed seeds (FAO nd). This is the same result as reported in the Oliver et al (2005) study where seeding with low-disturbance openers reduced weed numbers.

Table 5. Degree of weed incidence at 15 and 40 DAT of sweet corn varieties under conservation tillage practices

Treatment	Weed Incidence	
	15 DAT	40 DAT
Conservation Tillage Practices		
M_1 = Zero Tillage	light	heavy
M_2 = Minimum Tillage	moderately high	moderately high
Sweet Corn Varieties		
T_1 = Macho F1	moderate	heavy
T_2 = Sweet Supreme F1	moderate	moderately high
T_3 = Purple Magic F1	moderate	moderately high
T_4 = Hi-Brix XL F1	moderate	heavy
T_5 = Sugar King F1	moderate	moderately high

Legend:
No incidence= 0%
Light incidence= 1-20%
Moderate incidence= 21-40%
Moderately high incidence= 41-60%
Heavy incidence= 61-80%
Severe incidence= 81-100%

Table 6. Dominant weed species observed in the experimental area under the two tillage practices used in the study

Weed Group	Zero Tillage	Minimum Tillage
Broadleaves		*Ageratum conyzoides* L. (Kanding kanding)
Grasses	*Rottboellia cochinchinensis* L. (Gaho) *Eleusine indica* L. (Sabung-sabungan)	*Rottboellia cochinchinensis* L. (Gaho) *Commelina diffusa* B. (Alikbangon) *Eleusine indica* L. (Sabung-sabungan) *Cynodon dactylon L.* (Bermuda grass)
Sedges	*Cyperus rotundus L.* (Undo-unod)	*Cyperus rotundus L.* (Undo-unod)

Note: Words in the parenthesis are local names of the weeds

Table 7 shows the fresh and dry weights of weeds (g quadrat^{-1}) at 15 and 40 DAT under conservation tillage practices planted with different sweet corn varieties. Tillage operations significantly influenced fresh and dry weights of weeds at 15 DAT and fresh weight of weeds at 40 DAT. As expected, the weed population was higher in minimum tillage than zero tillage. This was due to the application of non-selective herbicide in zero tillage before transplanting that eliminated the existing vegetation.

For the fresh weight of weeds at 15 DAT, plots planted with Sugar King F1, Purple Magic F1, and Sweet Supreme F1 had lighter weight than plots planted with Macho F1 Hi-Brix XL F1. On the other hand, Hi-Brix XL F1 (T_4) had the heaviest fresh and dry weight of weeds 15 days after planting. After 40 days from transplanting, plots planted with Macho F1 had a lighter fresh weight of weeds, similar to plots with Sweet Supreme F1 (T_2), Hi-Brix XL F1 (T_4), and Sugar King F1 (T_5). The lightest dry weight was observed in plots planted with Sugar King F1 (T_5). The lighter weight of weeds was due to the vigorous growth characteristics of the sweetcorn Sugar King F1 variety. In effect, it lowers the amount of sunlight received by the weeds that helped suppress their growth and development, (Al-Kaisi et al 2012).

Table 7. Fresh and dry weights of weeds (g quadrat^{-1}) at 15 and 40 DAT under conservation tillage practices planted with different sweet corn varieties

Treatment	15 DAT		40 DAT	
	Fresh Weight (g)	Dry Weight (g)	Fresh Weight (g)	Dry Weight (g)
Conservation Tillage Practices				
M_1 = Zero Tillage	9.56b	5.38b	142.57b	28.71
M_2 = Minimum Tillage	92.44a	23.06a	187.13a	23.67
F test	**	**	*	ns
Sweet Corn Varieties				
T_1 = Macho F1	55.03ab	13.50b	146.38b	31.80ab
T_2 = Sweet Supreme F1	50.23bc	14.19b	180.85ab	29.80b
T_3 = Purple Magic F1	43.64bc	14.17b	197.85a	34.45a
T_4 = Hi-Brix XL F1	66.69a	17.16a	151.10ab	22.58c
T_5 = Sugar King F1	39.41c	12.07b	148.08ab	12.33d
F test	**	**	*	**
CV (a) %	21.48	12.99	10.30	21.96
CV (b) %	18.96	13.65	17.58	9.49

Means within a column followed by the same letter are not significantly different at 5% level, HSD.

Table 8 shows the interaction effect between conservation tillage practices and sweet corn varieties on the fresh and dry weight of weeds at 40 DAT. Results revealed that in Zero tillage, lighter fresh and dry weight (g) of weeds were observed than under Minimum tillage when planted with Sugar King F1 (T_5) and Sweet Supreme F1 (T_2). This was due to the non-selective herbicide used in zero tillage before planting the sweetcorn seeds. On the other hand, Minimum tillage had the heaviest fresh and dry weight (g) of weeds than in zero tillage when planted with Sweet Supreme (T_2), Purple Magic F1 (T_3), and Sugar King F1 (T_5).

The varietal characteristics of sweetcorn influenced the incidence of weeds. The result revealed that lower weights of fresh and dry weights of weeds were observed when planted with Sweet Supreme (T_2), Purple Magic F1 (T_3), and Sugar King F1 (T_5). This result can be attributed to its vigorous growth and broader leaves enough to shade the weeds thus, the lesser amount of sunlight captured by the weeds. According to (Sharma et al 2004) in the Wheat-Mungbean-Rice cropping system under subtropical climatic conditions, weeds were reduced when the canopy of the crops covered the soil surface compared to the control plots.

Table 8. The interaction effect on the fresh and dry weight (g) of weeds at 40 DAT as affected by conservation tillage practices and sweet corn varieties

Sweet Corn Varieties	Fresh weight (g)		Dry weight (g)	
	Zero Tillage	Minimum Tillage	Zero Tillage	Minimum Tillage
T_1 = Macho F1	149.20bcd	143.55bcd	31.35b	19.25de
T_2 = Sweet Supreme F1	115.80de	245.90a	20.00ce	30.60a
T_3 = Purple Magic F1	179.10abcd	216.60ab	48.60a	23.30abc
T_4 = Hi-Brix XL F1	172.70abcd	139.50bc	26.67bc	18.50cde
T_5 = Sugar King F1	96.05e	200.10abc	9.95e	24.70ab

Means within a column followed by the same letter are not significantly different at 5% level, HSD.

Incidence of Insect Pests

Table 9 shows the ratings for the incidence of the major corn pest (corn borer) infestation in different sweet corn varieties at 30 DAT (vegetative stage) and 60 DAT (reproductive stage).

Table 9. Incidence of corn borer infestation in sweet corn varieties as affected by conservation tillage practices

Treatments	Ratings	
	At Vegetative Stage (30 DAT)	At Reproductive Stage (60 DAT)
Conservation Tillage Practices		
M_1 = Zero Tillage	1.87	1.33
M_2 = Minimum Tillage	2.20	1.73
Sweet Corn Varieties		
T_1 = Macho F1	2.17	1.50
T_2 = Sweet Supreme F1	2.33	1.50
T_3 = Purple Magic F1	1.50	1.50
T_4 = Hi-Brix XL F1	2.33	1.67
T_5 = Sugar King F1	1.83	1.50
CV (a) %	12.81	20.62
CV (b) %	15.64	29.77

Means within a column followed by the same letter are not significantly different at 5% level, HSD.

There were no significant differences between tillage practices and varieties. However, it was evident that the lowest pest incidence (1.50) at 30 DAT and 60 DAT has been recorded in Purple Magic F1 (T_3) variety. A rating scale of 1 means no noticeable damage on the leaves of the corn plants.

CONCLUSION

The study revealed that the zero and minimum tillage practices did not significantly affect the total ear yield of sweetcorn. Weeds were significantly controlled by spraying a non-selective herbicide before planting that resulted in very low weed incidence in the zero-tillage treatment. Likewise, the zero-tillage practice obtained lower fresh weight (g) of weeds at 15 and 45 days after planting the sweetcorn. On the other hand, Hi-Brix XL F1 (8t ha^{-1}), Purple Magic F1 (7.44t ha^{-1}), and Macho F1 (7.45t ha^{-1}) obtained high marketable ear yields among the different sweet corn varieties. Moreover, soil chemical and physical properties did not differ significantly under the different tillage practices and soils planted with different sweetcorn varieties.

RECOMMENDATION

A similar study is recommended using the traditional tillage practice and variety of sweetcorn as checks to validate the results of the research particularly the effect of herbicide sprayed before planting sweet corn. Sensory evaluation of the different sweet corn varieties is to be included in further studies to compare the flavor and acceptability of the varieties. A long-term study on conservation tillage practices will be conducted to verify the effects of different tillage practices and sweet corn varieties on the soil properties.

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REFERENCES

Al-Kaisi M, Taylor E & Elmore R. 2012. Soil moisture conditions and crop water use. https://crops.extension.iastate.edu/cropnews/2012/06/soil-moisture-conditions-and-crop-water-use

Alam MK, Islam MM, Salahin N & Hasanuzzaman M. 2014. Effect of tillage practices on soil properties and crop productivity in wheat-mungbean-rice cropping system under subtropical climatic conditions. *The Scientific World Journal* 2014:1-15

Bhatia A, Sasmal S, Jain N, Pathak H, Kumar R & Singh A. 2010. Mitigating nitrous oxide emission from soil under conventional and no-tillage in wheat using nitrification inhibitors. *Agriculture, Ecosystems, and Environment* 136(3-4):247-253

Bescansa P, Imaz MJ, Virto I, Enrique A & Hoogmoed WB. 2006. Soil water retention as affected by tillage and residue management in semiarid Spain. *Soil and Tillage Research* 87(1):19-27

Corn and Sorghum Technical Working Group. 2017. Policies and guidelines in conducting the national cooperative testing of conventional and genetically trait hybrids, non-hybrids, and open-pollinated varieties (OPVs) of corn

Food and Agriculture Organization (FAO). nd. Suitable methods of tillage for the farm. http://www.fao.org/3/y5146e08.htm

Farkas C, Birkás M & Várallyay G. 2009. Soil tillage systems to reduce the harmful effect of extreme weather and hydrological situations. *Biologia*. 64(4):624-628

Fowler R and Rockström A. 2001. Conservation tillage for sustainable agriculture: an agricultural revolution gathers momentum in Africa. *Soil Tillage Research* 61(1–2):93-108

Halvorson AD, Mosier AR, Reule CA & Bausch WC. 2006. Nitrogen and tillage effects on irrigated continuous corn yields. *Agronomy Journal* 98(1):63-71

Hirsch A, Fatnassi H, Ragab R & Choukr-Allah R. 2016. Prediction of climate change impact on corn grown in the south of morocco using the salted model. *Irrigation and Drainage* 65(1):9-18

Ito M, Matsumoto T & Quinones MA. 2007. Conservation tillage practice in sub-Saharan Africa: the experience of Sasakawa Global 2000. *Crop Protection* 26(3):417-423

Josa R, Ginovart M & Solé A. 2010. Effects of two tillage techniques on soil macroporosity in the sub-humid environment. *Interational Agrophysics* 24(2):139-147

Kimble JM, Rice CW, Reed D, Mooney S, Follett RF & Lal R. 2007. Soil carbon management, economic, environmental, and social benefits. CRC Press, Taylor & Francic Group

Rashidi M and Keshavarzpour F. 2008. Effect of different tillage methods on soil physical properties and crop yield of melon (*Cucumis melo*). *ARPN Journal of Agricultural and Biological Science* 3(2):41-46

Landon JR. 1991. Booker tropical soil manual. Longman Scientific and Technical. Essex England

Nelson DW and Sommers LE. 1982. Methods of soil analysis, Part 2. American Society of Agronomy-Soil Science Society of America, 677 South Segoe Road, Madison, WI 53711, USA

Oliver E, Nybo B, Derksen D & Watson P. 2005. Southwest opener/rotations study: The effect of opener disturbance on weed populations and crop rotations in the dry brown soil. Agri-Food Innovation Fund, Diversified Farming Systems Program, Final Project Report

Olsen SR and Sommers LE. 1982. Methods of soil analysis, Part 1. American Society of Agronomy-Soil Science Society of America, 677 South Segoe Road, Madison, WI 53711, USA

Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD). 1980. Standard methods of analysis for soil, plant tissue, water, and fertilizer. PCARR, Los Baños, Laguna, Philippines

Piccoli I, Chiarini F, Carletti P, Furlan L, Lazzaro B, Nardi S, Berti A, Sartori L, Dalconi MC & Morari F. 2016. Disentangling the effects of conservation agriculture practices on the vertical distribution of soil organic carbon. Evidence of low carbon sequestration in North-Eastern Italy. *Agriculture, Ecosystems & Environment* 230:68-78

Powlson DS, Bhogal A & Chambers BJ. 2012. The potential to increase soil carbon stocks through reduced tillage or organic material additions in England and Wales: a case study. *Agriculture, Ecosystem and Environment* 146(1): 23-33

Saleque MA, Mahmud MNH, Kharun A, Haque MM, Hossain ATMS & Zaman SK. 2009. Soil qualities of saline and non-saline deltas of Bangladesh. *Bangladesh Rice Journal* 14(1&2):99-11

Sharma RK, Babu KS, Chhokar RS & Sharma AK. 2004. Effect of tillage on termites, weed incidence and productivity of spring wheat in a rice-wheat system of North-Western Indian plains. *Crop Protection* 23(11):1049-1054

Spiegel H, Dersch G, Hösch J & Baumgarten A. 2007. Tillage effects on soil organic carbon and nutrient availability in a long-term field experiment in Austria. *Bodenkultur* 58(1):47-58

Thakur RK, Baghel SS, Sharma GD, Sahul RK & Amule PC. 2012. Traning program on advances in agro-technologies for improving soil, plant, and atmosphere systems. Center of Advanced Faculty Training, Department of Soil Science & Agricultural Chemistry, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, India

Thompson D. 2018. Characteristics of sandy loam soil. https://homeguides.sfgate.com/characteristics-sandy-loam-soil-50765.html

United States Department of Agriculture (USDA). 2018. USDA branded food products database. https://data.nal.usda.gov/dataset/usda-branded-food-products-database

Selina Wamucii. nd. https://www.selinawamucii.com/insights/market/philippines/sweet-corn