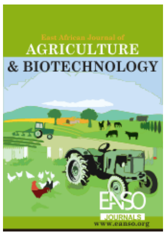

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Original Article

Effect of Different Seedbed Preparation Methods on Potato Yields in Kabarole District, Uganda

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ABSTRACT

Potato (Solanum tuberosum L) is one of the most important tuber crops produced in Uganda. However, the production and productivity of the crop are far below the world average due to poor crop seedbed preparation. An experiment for accessing the response of potato yields under different Seedbed preparation methods was conducted. Treatments consisted of two levels of seedbed preparation: Zero tillage and conventional tillage with and without NPK, laid out in Randomized Complete Block Design (RCBD) with three replications. Data was collected on growth parameters: average number of stems, estimated average plant height, estimated average plant width, and yield parameters: number of greened tubers, the weight of greened tubers, number of good tubers, and yield of potatoes. It was analysed using GenStat software. Results revealed that the proper seedbed preparation method was of paramount importance. Higher yields were observed in conventional tillage (14,744 Kg/ha) compared to zero-tillage (14,519 Kg/h). It was recommended that industrious seedbed preparation be encouraged among the farmers.

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INTRODUCTION

The potato (*Solanumtuberosum L.*) belongs to the family *Solanaceae* and is a herbaceous annual plant grown for its edible tubers. For potatoes, tubers are underground stem foods with high carbohydrates, exceedingly low in sodium and relatively rich in potassium and vitamin C. This makes potatoes a good dietary complement to meats and pulses (Nand *et al.*, 2011). After rice, wheat, and maize, potato is the world’s fourth most important food crop with global acreage rising faster than that of any other crop due to its high yield potential and excellent nutritional characteristics (Agricultural and Food Development Authority, 2022; FAOSTAT, 2019). Its annual production in the world is estimated at 370.44 million metric tons, produced in an estimated area of 17.34 million hectares. Among the root and tuber crops, potato ranks first in terms of the volume produced and consumed, followed by cassava, sweet potato, and yams (FAOSTAT, 2019). According to FAOSTAT, it provides roughly half of the world’s annual output of all roots and tubers, making it the largest non-cereal food and cash crop worldwide.

Potato crop provides more nutritious food (Devaux *et al.*, 2020). It is one of the most efficient crops in converting natural resources, labour, and capital into high-quality food with wide consumer acceptance. Potatoes are good sources of food, cash/income, and foreign exchange earnings for a good number of smallholder farmers in a number of developing countries. For low-income people in both urban and rural areas, the “Irish potato is a buried treasure” It grows fast, it is adaptable, high yielding and responsive to low inputs. Improvement of the potato production system in sub-Saharan Africa (SSA), where potato is an important cash and food crop, can be a pathway out of poverty (Schulte-Gelderman, 2013). Potato is a cash crop of the future for the densely populated East and Central African highlands, with a high potential to raise the livelihoods of smallholders.

In Uganda, potatoes were introduced by colonial administrators early in the 1900s and they rapidly spread in the highland areas of Uganda as a garden crop but was practically wiped out by late blight *Phytophthora infestans* (Akimanzi, 1982). Imports of potato seed from Kenya re-established the crop, but yields slowly declined due to a lack of suitable varieties and disease problems. In 1968/69, the Potato Improvement Programme for Uganda was initiated, and by 1973 a number of varieties were released, of which locally named Uganda Rutuku, Bufumbira, Malirahinda, Rosita, and Makerere are among those still being grown today. Potato production in Uganda reached 90,000 Ha in the 1970s, but the outbreak of a long period of political turmoil resulted in a dramatic decline in crop production to approximately 19,000 Ha in 1986 (Van der Zagg, 1994).

Potatoes grow well on a variety of soils. In some areas where potatoes are commercially grown, the soils are acidic, whereas in others, they are alkaline. The ideal soil for potato growing is deep, well-drained and friable and has a pH between 5 and 6.5 (Center for Agroecology & Sustainable Food Systems, 2017). High in organic matter soils such as peat or muck, if adequately drained, can also produce high-quality potatoes, particularly for the fresh market. Sandy soils which contain little clay or little organic matter and have almost no soil structure, when properly irrigated and fertilised would produce high yields of tubers with excellent culinary and processing quality (Department of Agriculture, Forestry and Fisheries Republic of South Africa, 2013).

Potato Production and Constraints

In 2021, Uganda’s potato production was estimated at 327,300 million MT from an estimated area of 111,100 Hectares (Ha) – this is approximately 3 MT/Ha (Netherlands Enterprise Agency, 2021). According to NAADS (2020), the farm-level productivity was 37.066 t/ha. This is a low yield compared to the Netherlands’ potato productivity of 46 tons/ha (BizVibe, 2018). Uganda’s low potato yield is attributed to low-yielding varieties, poor management practices and a lack of quality seed potatoes, among other

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factors. Low soil fertility and inadequate levels of nutrients are two major constraints to potato production preventing most farmers from realising the high agricultural productivity in developing countries. The extensive nutrient depletion, soil degradation, and soil quality deterioration found throughout Uganda lead to poor yield of potatoes (Muzira *et al.*, 2018). In addition, many farmers use badly prepared seedbeds.

Diseases are the major limiting factor and these include; - late blight caused by *Phytophthora infestans*, bacterial wilt (BW) caused by *Ralstonia solanacearum* (Muthoni *et al.*, 2016) and viruses (Muhinyuza *et al.*, 2012). Late blight is the most devastating disease of potatoes leading to yield losses. This disease is present in all main potato growing areas (Hijmans & Spooner, 2001) and is favoured by moderately low temperatures and extended times of leaf dampness. It is particularly detrimental in the highland tropics, where potatoes are grown throughout the year, coupled with the poor ability of farmers to understand and manage the disease (Garrett *et al.*, 2001). Late blight regularly reduces potato productivity leading to large differences between actual and realised yields. Attempts to develop late blight-resistant cultivars, therefore, call for superior attention to disease management.

In general, diseases are the main constraints limiting potato production across seasons in all regions (Namugga *et al.*, 2017). Other challenges are; limited soil nutrients, pests, high cost of agro-inputs, limited land for potato production, reduced yields and unfavourable weather conditions. Major diseases are bacterial wilt in the lowlands and late blight in the highland areas.

Lack of balanced fertilisation management leads to poor production - both yield and quality of tubers are diminished (FAO, 2009). Efficient potato nutrient management systems are needed to ensure that all essential plant nutrients are available in appropriate amounts. Proper scheduling of fertiliser application is also important to provide optimal nutrients for vine and tuber growth.

Most Ugandan soils cannot supply all essential plant nutrients in sufficient amounts to support the good growth of potatoes (Muzira *et al.*, 2018). Application of fertiliser, particularly NPK 17:17:17 at 200 Kg/ha is often required to boost production. In addition, proper preparation of seedbeds such as conventional tillage is important to increase nutrient uptake in crop plants and improve yields (Uzatunga *et al.*, 2021). Conventional tillage is a tillage system using cultivation as the major means of seedbed preparation and weed control. Context: Typically includes a sequence of soil tillage, such as ploughing and harrowing, to produce a fine seedbed and also the removal of most of the plant residue from the previous crop (Glossary of Statistical Terms, 2003). Nutrients applied to the soil are either taken up by the crop or retained in the soil as soil nutrient stocks or lost from the soil through various processes (Kumar *et al.*, 2012). Actual nutrient uptake would vary with crop yield and variety. The nutrient requirement of the crops can be met by nutrients available in the soil and by nutrient additions (Warncke *et al.*, 2004).

In Uganda, Kabarole District inclusive, the potato farmers use traditional soil fertility improvement mechanisms such as farmyard manure application. The seedbed preparations include zero tillage with chop and plant, bush burning and application of herbicide. Application of inorganic fertiliser is minimal if any (Kabarole DLG, 2015). Development of a cost-effective nutrient management program takes into account the nutrient requirements of the crop being grown, the use of the conventional type of seedbed prepared and the nutrient status of the soil (Warncke *et al.*, 2004). In contrast to most crops, potatoes are relatively shallow-rooted crops and require intensive management to promote growth and yield (Carl & Peter, 2015). Management factors, including seedbed preparation methods and fertility decisions, influence potato yield, quality, and storage properties (Mikkelsen, 2006). For efficient soil management, a farmer needs to improve the desirable soil characteristics by means of good agricultural practices. In order to ensure sustainable and high agricultural

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productivity, an appropriate choice of fertilisers, with balanced rates, method and time of application and ensuring proper seed bed preparations form important components of good agricultural practices (FAO & IFA, 2000).

Statement of the Problem

Seedbed preparation is among the agro-management practices of potato growing and production, especially under rain-fed conditions. According to Agriculture and Food Development Authority (2017), conventional seedbed preparation coupled with an appropriate rate of fertiliser application leads to increased potato production and yields, resulting in attaining self-sufficiency in food availability and feed. However, efforts are still required to improve these techniques to get maximum yield. Seedbed preparation methods and planting techniques have a great role to play in increasing potato yield. Often times farmers use zero tillage methods for preparing seedbeds. Zero tillage has many disadvantages, mainly resulting from reliance on herbicide usage, bush burning and slashing, chopping, and plant, not earthling of the plant nor ensuring efficient plant density. It is marred with a number of constraints, including difficulty in weed control, hardpan caused by hoeing at the same depth year after year and crop roots may not grow well as with planting basins, and less water infiltrating into the soil (Infonet Biovision, n.d). Improved seedbed preparation methods and planting technique not only ensure proper adjustment and optimum plant population in the field but also enables the plants to utilise the land and other added resources more efficiently for growth and development.

Potato growing farmers in Kabarole District, in Uganda, have consistently got lower yields that are below the national productivity level, 37.066 tons/ha (Kabarole DLG, 2015). This is attributed to a number of factors, seedbed preparation methods not the least. To ensure increased production, different government institutions and NGOs have advocated the adoption of sustainable land management practices, including conventional seedbed preparation methods. However, the majority of farmers have continued opting to use a zero tillage system of seedbed preparation because it is less costly and tedious compared to the conventional seedbed method (Kabarole DLG, 2015). It is on this basis that this study was conducted to establish the effect of seedbed preparation under the appreciation of NPK fertiliser.

Significance of the Study

The results of this study have provided further information on the effect of seedbed preparation on potato production and yields. The study results are helpful to students, policymakers, practitioners, and farmers who are trying to enhance potato field preparation to ensure increased yields. The study results have added and widened knowledge of the already existing literature on seedbed preparation in potato production, in particular in Kabarole District, which informs the same in the whole Country. Therefore, the findings from this study form a foundation for further research in this area.

LITERATURE REVIEW

There are two methods of seedbed preparation, namely, zero and conventional tillage. Conventional tillage is a system in which land goes through 1st ploughing, 2nd ploughing and disc harrowing before planting. On the other hand, zero tillage refers to a situation in which minimum preparation of land is done, including activities such as burning, slashing, and spraying. A key to plant growth rests in the concept that there must be good seed-to-soil contact, which helps the seed utilisation of moisture in the soil, and later the emerging plant can utilise the nutrients in the soil (Oregon State University, 2022). This concept usually assumes that a fine seedbed would optimise seed germination and survival rate. It may necessitate a more finely pulverised soil for smaller seeds. Diligent seedbed preparation/tillage is one way that enhances seed-to-soil contact. Tillage is the use of implements to prepare land for planting. Seedbed preparation for potatoes is done in such a way that it will ensure

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not only quick emergence but also deep penetration of the roots and good drainage.

The different methods of conservation tillage reduce the amount of tilling done to the soil, and some forms like no-tillage, eliminate tillage. No-tillage is a farm management practice where seeds are planted directly into the untilled soil. Ojah and Bhattacharjee (2022) found that zero tillage technology is done without land preparation after harvesting the paddy; hence the cost of cultivation is less than normal potato cultivation, which in turn helps the farmers to get a better income. According to Ojah and Bhattacharjee, zero tillage allowed crop intensification and aid to additional farm income without much soil and environmental degradation as compared to any traditional practices. The findings showed that it benefited the farmers by cutting down the cost of labour and other expensive farm practices, along with minimising the associated risks of environmental degradation.

Neglecting potato seedbed preparation may result in inferior crops, predisposed to soil compaction, poor aeration, and drainage (Grant, 2022). Farmers normally use a form of no-tillage by using a stick to make a hole in the soil for the seed and covering the hole using their feet. However, no-tillage, as we know it today, did not occur until the late 1940s with the invention of the herbicides 2,4-D and later the herbicides atrazine and paraquat (Derpsch, 2004). Herbicides made it possible to substitute weed control using hand labour and mechanical tillage with weed control using chemicals. Since that time, the area under no-tillage for major crops in the United States has grown to an estimated 59 million acres in 2007 (Larson *et al.* 2010). Joshua and Jürgen (2015) conducted a household survey in Uganda on zero tillage; they found that; zero tillage increased pest and disease problems, and pesticide use could raise environmental and health concerns.

No-tillage has also been found to have a number of advantages that farmers and society as a whole may find beneficial. In trials, Walker Institute (2020) appreciated potato yields increase with the application of NPK fertiliser. This was attributed to a number of factors, including the previous crop also providing additional nutrients and improving the soil structure. Soil structural properties were also said to be important for getting regular good-sized roots as the chemical properties of the soil. However, in Derpsch *et al.* (2010), conventional tillage increased tuber yields by 30% compared to zero tillage. The scholars found that no-tillage has expanded to soils and climates earlier thought inadequate for practising the technology successfully. No-tillage has been associated with several reduced fuel, labour, and machinery repair costs (Lankoski *et al.*, 2004). However, more herbicides are needed to help control weeds when using no-tillage

Qasim *et al.* (2013) assessed the effects of different planting systems on the yield of potato crops in Kaghan Valley in Pakistan. Desiree was tested against different planting systems for yield and yield components. They found that the conversion of potatoes from conventional methods to wide bed planting systems may increase water and nitrogen use efficiency in commercial potato production systems. The results showed that maximum tuber growth (88.7%), number of stems per plant (3.5), plant expansion (45.5 cm), the average number of tubers per plant (10.1) and yield per hectare (12.4 t/ha) were significantly different and higher when potatoes were planted on a wide bed and covered with soil from one side. The tallest plants (53.4 cm) were observed when potatoes were sown on the ridges. The maximum number of green potatoes (12.5) and injured potatoes (5.3%) were observed when the tubers were planted following the local farmers' method.

As such, farmers are constantly looking to adopt farm management practices that increase yields and decrease input costs. Promising results have shown that proper seedbed preparation under soil nutrient improvement using NPK, which is often lacking in potato growing in Kabarole District, improves yields.

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METHODS AND MATERIALS

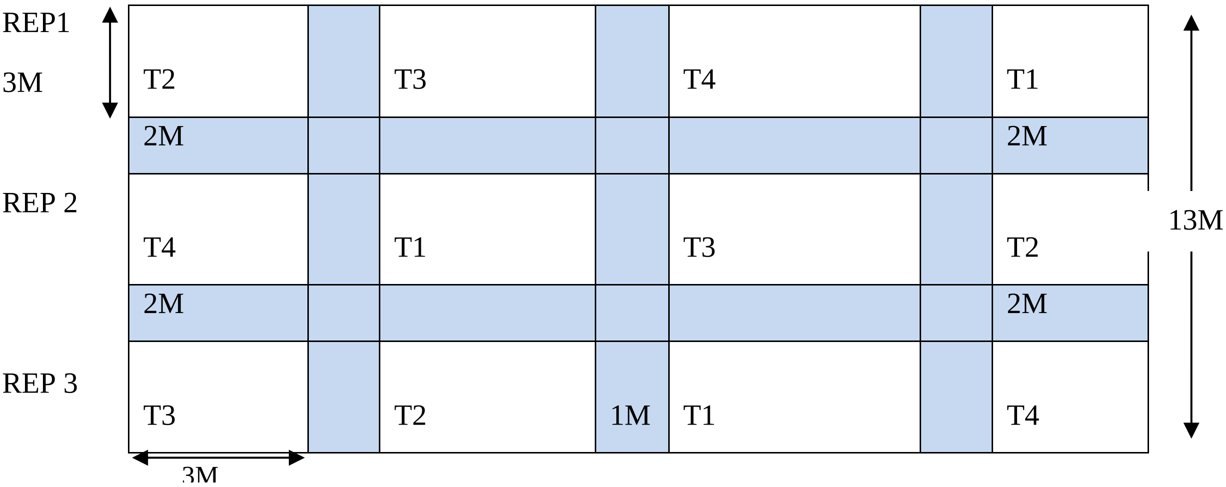
Study Area

The research was conducted in Rweganju Sub-County, Kabarole District. Kabarole District is located in western Uganda in the Rwenzori region at an altitude of 1134 m, Latitude 0^{0} $50^{\prime}$10N, Longitude 33^{0} $41^{\prime}$ 10E. The mean annual rainfall is 1100 mm, which is fairly equally divided into two seasons: the first season is during the months of March/April, while the second season is during September/November. The mean annual temperature is 25 ^{0}C.

Experimental Treatments and Design

The study examined seedbed preparation methods under NPK fertiliser application at 200 Kg/ha, that is, zero tillage and conventional tillage. Actual treatments were: 1 = Zero tillage with No NPK applied (T1); 2 = Zero tillage with 200 Kg/ha of NPK applied (T2); 3 = conventional tillage with No NPK applied (T3); and 4 = Conventional tillage with NPK (at 200 Kg/ha) applied with (T4). These were laid out in a Randomized Complete Block Design (RCBD) and replicated three times, as indicated in *Figure 1* below.

Figure 1: The design and layout of the Experiment



Key: ***Treatment 1 (T1)****- No Till and No NPK;* ***Treatment 2 (T2)*** *- No Till and 200 kg/ha NPK;* ***Treatment 3 (T3)*** *-Conventional tillage and No NPK;* ***Treatment 4 (T4)*** *- Conventional tillage and 200 kg/ha NPK*

The experiment was carried out for two seasons, 2019(a) and 2019(b). The plots used measured 3 m x 3 m separated by 1m between plots and 2 meters between blocks. The study used the NAROPOT4 potato variety, commonly known as Rwangume. It was planted at a spacing of 75 cm between rows and 30 cm between plants within rows, with one tuber per hill. This gave a total of 50 plants per plot. The study used recommended NPK17:17:17 and the dose of 200 Kg/ha at planting. This was done by pouring 3.6 gm in each planting hole. Disease-free potato tubers of egg-size seeds obtained from NARO-Kachwekano Zonal Agricultural Research and Development Institute (KaZARDI) were used.

Experimental Field Management

During the growth period, weeding was done twice per season to maintain a weed-free environment. Fungicide, pesticide application and roguing were carried out uniformly for each plot as per the recommendation over the course of time.

Experimental Measurements

Each of the fifty plants in each treatment was tagged for easy identification. Details of the measurements were as follows:

- Crop emergence - counting the sprouts was done 20 days after the planting. The emerging plants for each treatment were counted separately, and the percentage average emergence was determined.

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- Number of stems per plant. - this was done delete at 60 days). The main stem and the branches were counted for each plant in each treatment. The average number of stems per plant was then computed for each treatment.
- Plant height and Plant width - the plant height and spread measurements were taken when the plant's vigour was at its peak (70 Days after Planting). Plant height was measured from the bottom of the stem to the last leaf in centimetres, while the spread was measured from the plant canopy's furthest point to the furthest spread (*Figure 1*). The spread gives a measure of the plant's capacity to capture radiant energy required for photosynthesis.
- Greened and damaged tubers - this was done during harvest. The numbers of damaged and greened tubers were sorted out and weighed using a digitalised weighing scale balance separately for each treatment. This was done because tubers which are exposed to direct sunshine green up.
- Yields per treatment - the tubers from each treatment were weighed likewise using a digitalised weighing scale balance at harvest after removing all the debris and soil particles. The results were then converted into tuber yields/ha for each treatment. This was done to determine potato productivity in response to seedbed preparation and NPK application.
- Grading of Tubers - the tubers were graded into different sizes (small, medium, and large) based on size (diameter).

Data Analysis

Data collected was captured into an Excel sheet, where it was organised and exported to GenStat for analysis. Analysis of variance (ANOVA) was done based on the approach in the GenStat software used. The mean, ANOVA, and Least Significant Difference (LSDs) were used to separate significant means. Details of the ANOVA for each parameter are given in the appendices.

RESULTS

Effect of Seedbed Preparation (Tillage) with NPK Fertilizer Application on Average Number of Stems Per Plant

The effects of seedbed preparation (tillage) with NPK fertiliser on an average number of stems per plant were generated and presented in *Table 1.*

Table 1: Effect of seedbed preparation with NPK fertiliser application on the average number of stems per plant

		NPK		Mean
		Zero	**200 Kg/ha**	
Season 1	No tillage	7.30	8.11	7.71
	Conventional Tillage	7.63	7.59	7.61
	LSD comparing tillage methods: 0.3393			
Season 2	No tillage	6.48	6.82	6.65
	Conventional Tillage	6.48	6.63	6.56
	LSD comparing tillage methods: 0.2693			

The average number of stems per plant that emerged are presented in *Table 1* for Season 1 and Season 2. In Experiment 1, there was no significant difference between the no tillage treatment and conventional tillage. The results show that there were no significant differences between seedbed preparation methods though the no tillage method had a slightly higher mean number of stems per plant (7.71) compared to conventional tillage (7.61).

The average number of stems per plant that emerged in Season 2 is presented in *Table 1.* In Experiment 2, the mean number of stems per plant in the no tillage and conventional tillage were not significantly different. However, no-tillage had a slightly higher number of stems that emerged

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(6.65) compared to conventional tillage (6.56). Overall, Experiment 1 had a higher number of stems that emerged than Experiment 2.

Effect of Tillage with NPK Fertilizer Application on Average Plant Height

The effects of seedbed preparation (tillage) with NPK fertiliser application on average plant height were generated and presented in *Table 2.*

Table 2: Effect of seedbed preparation (tillage) with NPK fertiliser application on average plant height (Cm)

		NPK		Mean
		Zero	**200 Kg/ha**	
Season 1	No tillage	38.93	67.68	53.31
	Conventional Tillage	43.49	54.57	49.03
	LSD comparing tillage methods: 3.965			
Season 2	No tillage	34.52	59.88	47.20
	Conventional Tillage	38.94	53.69	46.32
	LSD comparing tillage methods: 3.684			

The mean plant height in Season 1 is presented in *Table 2*. The results showed that in Experiment 1, the difference between no-tillage and conventional tillage was significant, with the no-till treatment giving an average plant height of 53.31 Cm.

During Season 2, the results showed no significant difference between seedbed preparation methods. The results showed that in Experiment 2, the difference between no-tillage and conventional tillage was significant, with the no-till treatment giving an average plant height of 47.20 Cm. Overall, Experiment 1 had a taller plant height than Experiment 2.

Effect of Tillage with NPK Fertilizer Application on Plant Width

The effects of seedbed preparation (tillage) and NPK fertiliser application on average plant width are presented in *Table 3* below.

Table 3: Effect of seedbed preparation (tillage) and NPK fertiliser application on average plant width (Cm)

		NPK		Mean
		Zero	**200 Kg/ha**	
Season 1	No tillage	43.41	83.2	63.31
	Conventional Tillage	48.72	69.74	59.23
		LSD comparing tillage methods: 5.25		
Season 2	No tillage	41.28	70.66	55.97
	Conventional Tillage	44.36	64.65	54.51
	LSD comparing tillage methods: 4.33			

The mean plant width is presented in *Table 3* for Season 1 and for Season 2. The results show that in Experiment 1 method of seedbed preparation did not significantly affect plant width. No-till had slightly wider plants (63.31 Cm) compared to conventional tillage (59.23 Cm).

The results of Season 2 followed a similar pattern. There was no significant difference between tillage methods. However, no-tillage had larger plant width (55.97 Cm) compared to conventional tillage (54.51 Cm). Overall, Experiment 1 had a taller plant height than Experiment 2.

Effect of Tillage with NPK Fertilizer Application on the Number of Greened Tubers

The effects of seedbed preparation (tillage) with NPK fertiliser on the number of greened tubers were generated and presented in *Table 4*.

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Table 4: Mean effect of seedbed preparation (tillage) with NPK fertiliser application on greened tubers

		NPK		Mean
		Zero	**200 Kg/ha**	
Season 1	No tillage	3.11	1.92	2.52
	Conventional Tillage	1.82	2.00	1.91
	LSD comparing tillage methods: 1.115			
Season 2	No tillage	1.963	1.89	1.93
	Conventional Tillage	1.19	1.07	1.13
	LSD comparing tillage methods: 0.733			

The mean of greened tubers for Season 1 is presented in *Table 4.* The results show that in Experiment 1, the zero and conventional tillage were significantly different. No-tillage had a higher number of greened tubers (2.52) compared to conventional tillage (1.91).

The mean of greened tubers for Season 2 is presented in *Table 4.* The results show that in Experiment 2, the zero and conventional tillage were significantly different. No-tillage had a higher number of greened tubers (1.93) compared to conventional tillage (1.13). Overall, Experiment 2 had a lower number of greened tubers than Experiment 1.

Effect of Tillage with NPK Fertilizer Application on the Weight of Greened Tubers

The effects of seedbed preparation (tillage) and NPK fertiliser on the weight of greened tubers were generated and presented in *Table 5*. The yield was converted from grams per square meter to kilograms per hectare (1 gram per square meter = 10 kg per hectare).

Table 5: Mean effect of seedbed preparation (tillage) with NPK fertiliser application on the weight of greened tubers (Kg/ha)

		NPK		Mean
		Zero	**200 Kg/ha**	
Season 1	No tillage	74.73	46.18	60.46
	Conventional Tillage	43.00	49.26	46.13
	LSD comparing tillage methods: 23.97			
Season 2	No tillage	52.76	57.66	55.21
	Conventional Tillage	38.43	28.77	33.60
	LSD comparing tillage methods: 17.95			

The mean weight of greened tubers for Season 1 is presented in *Table 5*. The results show that in Experiment 1, the zero and conventional tillage were significantly different. No-tillage had the higher weight of greened tubers (60.46 Kg/ha) compared to conventional tillage (46.13 Kg/ha).

The mean weight of greened tubers for Season 2 is presented in *Table 5.* The results show that in Experiment 2, the zero and conventional tillage were significantly different. No-tillage had a higher weight of greened tubers (55.21 Kg/ha) compared to conventional tillage (33.60 Kg/ha). Overall, Experiment 2 had better results, lower weight to greened tubers than Experiment 1.

Effect of Tillage with NPK Fertilizer Application on Number of Good Tubers

The effects of seedbed preparation (tillage) and NPK fertiliser on good tubers were generated and presented in *Table 6*.

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Table 6: Mean effect of seedbed preparation (tillage) with NPK fertiliser application on the number of good tubers (Kg/ha)

		NPK		Mean
		Zero	200 Kg/ha	
Season 1	No tillage	501	766	633
	Conventional Tillage	469	847	658
	LSD comparing tillage methods: 105.5			
Season 2	No tillage	511	816	663
	Conventional Tillage	493	823	658
	LSD comparing tillage methods: 109.6			

The mean number of good tubers for Season 1 is presented in *Table 6*. The results show that in Experiment 1, the zero and conventional tillage were significantly different. Conventional tillage had a higher number of good tubers (658) compared to no tillage (633).

The mean of plant height for Season 2 is presented in *Table 6*. The results show that in Experiment 2, the zero and conventional tillage were significantly different. Tillage had a higher number of good tubers (658) compared to conventional tillage (633). Overall, Experiment 2 had a higher number of good tubers than Experiment 1.

Effect of Tillage with NPK Fertilizer Application Mean Yield

The effects of seedbed preparation (tillage) and NPK fertiliser on yield were generated and presented in *Table 7* below.

Table 7: Mean effect of seedbed preparation (tillage) with NPK fertiliser application on yield (Kg/ha)

		NPK		Mean
		Zero	200 Kg/ha	
Season 1	No tillage	11,349	16,407	13,878
	Conventional Tillage	12,086	17,934	15,010
	LSD comparing tillage methods: 1899.4			
Season 2	No tillage	12,259	16,780	14,519
	Conventional Tillage	11,914	18,024	14,969
	LSD comparing tillage methods: 1918.0			

The mean yield for Season 1 is presented in *Table 7*. The results show that in Experiment 1, the zero and conventional tillage were significantly different. Conventional tillage had a higher yield (15,010 Kg/ha) compared to no tillage (13,878 Kg/ha).

The mean of yield for Season 2 is presented in *Table 7*. The results show that in Experiment 2, the zero and conventional tillage were significantly different. Conventional tillage had a higher yield (14,969 Kg/ha) compared to no tillage (14,519 Kg/ha). Overall, Experiment 2 had a better yield than Experiment 1.

DISCUSSION

The study assessed the effect of potato yields on different seedbed preparation methods, that is, under no-till and conventional tillage seedbed preparation methods. The study parameters used for assessment were: the average number of stems; average plant height; average plant width; number of greened tubers; the weight of greened; number of good tubers; and yield per hectare of potatoes.

The mean numbers of stems in Seasons 1 and 2 were only significantly higher in the treatment with no-till. This is because in no-till when stolons are not earthed up that are not covered with

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enough soil, they get exposed to sunshine, enhancing foliage formation through photosynthesis and becoming stems. On the other hand, in conventional tillage, stolons, when they are well earthed up, bulge and become tubers. Potatoes are not root crops—unlike cassava, which develops tubers from roots, potatoes grow tubers from stolons, that is, stem nodes/buds. The average number of stems slightly decreased with conventional tillage. This is because, relatedly, when stolons are well earthed-up, in the case of conventional tillage, they are not exposed to direct sunlight, thus bulging and becoming potato tubers. These findings agree with Oregon State University (2022), which observed that the key to plant growth rests in the concept that there must be good seed-to-soil contact which helps the seed to utilise the moisture in the soil and later, the emerging plant can utilise the nutrients in the soil. The findings also are in agreement with Qasim *et al.* (2013), who assessed the effects of different planting systems on the yield of potato crops and found that conversion of potatoes from conventional methods to wide bed planting systems may increase water and nitrogen use efficiency in commercial potato production system by reducing the amount of irrigation water and water applied nitrogen fertiliser bypassing the potato root zone.

Similar results were observed in average plant height, average plant width, number and weight of greened tubers were observed in Treatments with no tilling. Properly preparing beds for potatoes is crucial. Neglecting potato bed preparation may result in inferior crops. Improperly prepared beds may be predisposed to soil compaction and poor aeration and drainage, the three conditions that potatoes abhor (Grant, 2022). The results of this study are in agreement with the findings of Obalum *et al.* (2020), who observed that conventional tillage improved most soil properties better than the other treatments and also gave the best tuber yield of sweet potato. The results also are in agreement with Lankoski *et al.* (2004), who observed that no-tillage with the application of herbicides is needed to help control weeds when using no-tillage, whose overuse can be detrimental to crops and humans.

CONCLUSION

The study established the effect of different seedbed preparation systems on potato yields in the Kabarole District. It determined the response of potatoes' yield to different seedbed preparation. The analysis of means of the average number of stems, average plant height, plant width, number of greened tubers, number of good tubers, the weight of green tubers and yield indicated noticeable differences in the measure in the above-enumerated variables in the view of seedbed preparation. The contribution of conventional tillage was of paramount importance, seeing the productivity of 14,969 Kg/ha compared to no-tillage's 14,519 Kg/ha. The effect of tillage could be due to earthling into a hill that sees potato roots easily penetrating the soil.

Recommendation

Based on the study findings, it was recommended that industrious seedbed preparation is paramount as higher yields are observed where there is good seedbed preparation. This will go far towards getting healthier crops compared to the zero tillage practices, where herbicide usage, bush burning and slashing are used as the methods of seedbed preparation.

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