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EFFECT OF DIFFERENT TILLAGE PRACTICES ON GROWTH AND YIELD OF MAIZE AT SYANGJA, NEPAL

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Anushka Kiran Basnet [1] (B.Sc. Ag), Agriculture and Forestry University, Rampur, Chitwan
anushkakiranbasnet@gmail.com, ph no. 9867878833
Hem Raj Bhatta[2] (B Sc. Ag), Agriculture and Forestry University, Rampur, Chitwan
hemrajbhatta3@gmail.com, ph no. 9867590772
Madan Simkhada[3] (B. Sc. Ag), Agriculture and Forestry University, Rampur, Chitwan
madansimkhada88@gmail.com, ph no. 9863933153
Madhav Pandey[4](PhD), professor at Agriculture and Forestry University, Rampur, Chitwan
mpandey@afu.edu.np, ph no. 9860370410

Abstract

Tillage practices have a strong impact on maize (*Zea mays* L.) production largely affecting its performance . A field experiment was conducted to evaluate the effect of different tillage methods on growth and yield o f maize (cv. Advanta-756). In total, six tillage methods (No-tillage, Spade tillage, MB plough, Rotary ploug h, MB + Rotary plough and Mulch tillage) were evaluated following RCBD with three replications.

Data were recorded for various growth parameters (plant height, leaf number, LAI, stem girth, root length), days to tasseling, and yield attributes (TSW, rows/cob, kernels/row, cob weight, cob length and cob diameter) and grain yield. Results showed that tillage had a significant effect on various traits. Rotary tillage had a positive effect on plant height, stem girth, cob weight and kernel per row. The highest grain yield was recorded for Rotary tillage (1139.25 kg/ha), which demonstrated that tillage can enhance growth and yield of maize.

INTRODUCTION

Maize, (*Zea mays)* of family Gramineae, is the third largest food source in the world used for food, fodder, biofuel etc (Yeboah et al., 2016). Various mechanical manipulation can be done on soil for nurturing maize. Tillage can be termed as the mechanical manipulation of soil. Modernization brings new concept on soil manipulation. Tillage is part of our agricultural system from hundreds of years. FAO is actively involved in promoting reduced tillage methods mainly in developing countries (FAOSTAT, 2024). Tillage methods like reduced tillage, conservation tillage, mulch tillage etc, are also developed to conserve soil texture alongside to increasing productivity (Jug et al., 2007). In Nepal, conventional method of farming is adopted widely which not only disturbs the harmony of soil, but also is time and power consuming (Aikins et al., 2012). Mid hills and high hills have higher contribution for maize production. but, still the demand of maize is unfulfilled. Demand for maize lies at rate of 11% per annum (Ghimire & Gyawali, 2023). The compounded annual growth rate of maize imports from various countries was 30.5% over the last eight years in Nepal (Nath Ghimire & Timsina, 2019). Among, total maize production, mid-hill contributes 72.85%, Terai contribute 17.36% and high hills contribute 9.77% whereas, Himalayan region remains bare (MoALD, 2023) A good quality seed needs good environment to grow and without it, it cannot even germinate. The soil moisture and thermal status resulted from tillage system provide a good environment for growth and development thus, resulting in increased crop yield(Yang et al., 2018). The study of tillage in maize crop is very much important in order to find out the productivity of maize in different soil structure. Tillage plays an important role for establishment of this crop which of course, has a hand in greater production. In this study, maize variety name ‘Advanta-756’ an unregistered variety in Nepal,

MATERIALS AND METHODS

The study took place at Muktinath farming center of excellence, Aadhikhola Gaupalika, Ward No. 6, Nibuwabot, Syangja which lies at an altitude of 1144 masl. It is the Mid hilly region with day temperature

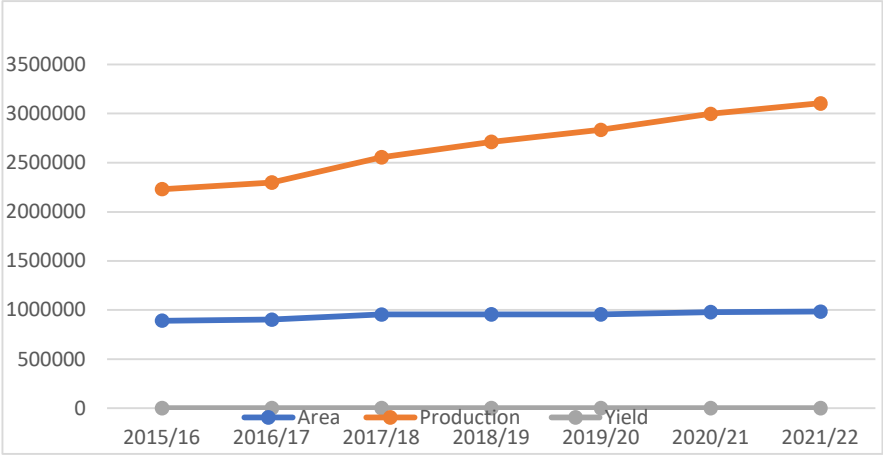

Figure 1. Maize area, production and yield throughout the years

of 11-24 ^{0}C and night temperature of 1-16 ^{0}C. Average annual precipitation of syangja is 242.61 mm. The study was taken on Kharif maize of variety, Advanta 756, yellow maize genotype which is an unregistered variety in Nepal. The design of experiment was Randomized complete block design (RCBD) with treatments namely: Zero tillage, spade tillage, mb plough tillage, rotary power tillage, mb+ rotary power tillage and mulch tillage.

- Spade was used to dig the soil up for field preparation.
- MB plough tillage was done with the help of Mold Board mounter on a power tiller.
- For Rotary power tillage rotavator was used on a power tiller.
- For both MB and Rotary power tillage, MB plough followed by rotary tillage
- For mulch tillage, MB plough was done followed by Rotary tillage. And the field was covered with dried oat straw after sowing.

RESULTS AND DISCUSSION

Tillage practices influence soil physical, chemical and biological characteristics, which alter plant's yield and growth. It modifies soil structure by changing its physical properties. The results differences in number, shape and size distribution of the pores, which controls soil air, water, agricultural chemicals other required nutrients. This controls erosion, runoff and increases crop stability(Jug et al., 2007). Changes in soil properties affect the seedling emergence, crop performance, root distribution and crop yield (Khusairy et al., 2006). This study was planned to determine the effect of different tillage methods on grain yield and yield components of an unregistered variety of maize (*Zea mays*).

An experiment was conducted at the research field of Muktinath Krishi Company limited, Syangja, to observe the growth, phenology and yield attributes of a yellow maize genotype ADVANTA-756 under different planting configurations. Data on different growth and yield parameters of maize were recorded. The results have been presented and discussed with the help of tables and possible interpretations have been given.

Effect of different tillage practices on Plant height

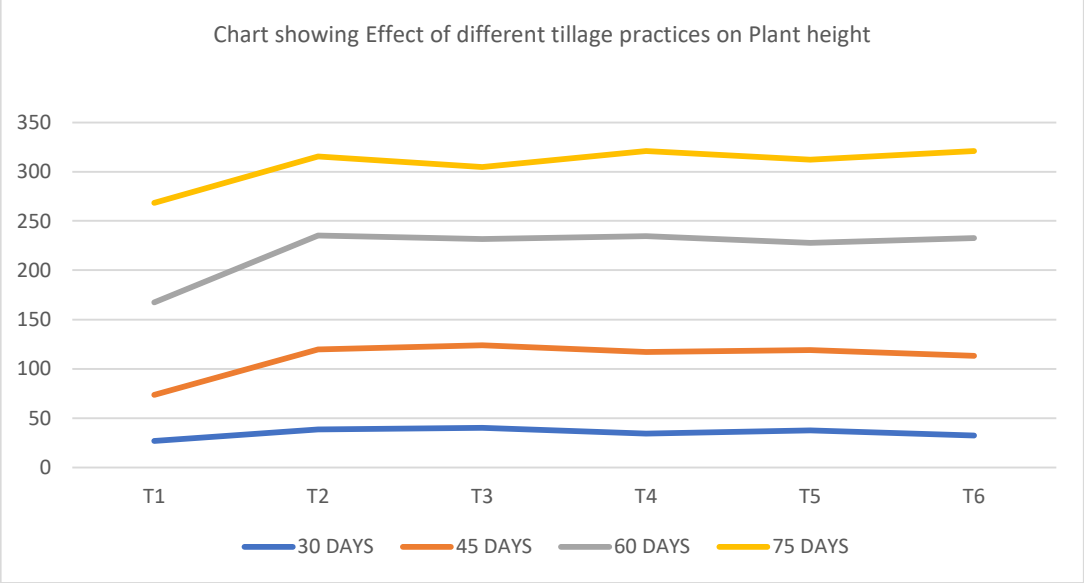

Figure 2. chart showing effect of different tillage practices on plant height

As shown in figure 2. Significant differences in growth were observed among treatments during the first 30 days after sowing. The zero-tillage treatment (T1) exhibited the least growth compared to the other treatments, likely due to limited soil-seed interaction and growth inhibition caused by residual roots from the previous crop.(Jones et al., 1996) Following this period, the organic mulch treatment showed reduced growth, which may be attributed to limited light exposure due to the straw covering.(Saxena et al., 1997) In contrast, T3 demonstrated the highest growth, likely benefiting from the deep tillage performed by the MB plough, which enhanced maize root development.(Lamichhane et al., 2015). After 60 days, zero tillage continued to lag behind, while the other treatments maintained better performance. Spade tillage exhibited the highest growth, followed by MB plough. By 75 DAS, rotary tillage outperformed the other treatments, with plant height being highest under this system. Different tillage modes and soil surface coverage techniques had different effects on soil and these regulations were related to cultivation time and have greater effect during growth.(Yang et al., 2018). Zero tillage modes increased the temperature in top layers of soil which is favorable to plant growth. The root growth was restricted by the roots of initial cereal resulting in reduced plant height.(Yang et al., 2018).

Effect of tillage on Leaf numbers

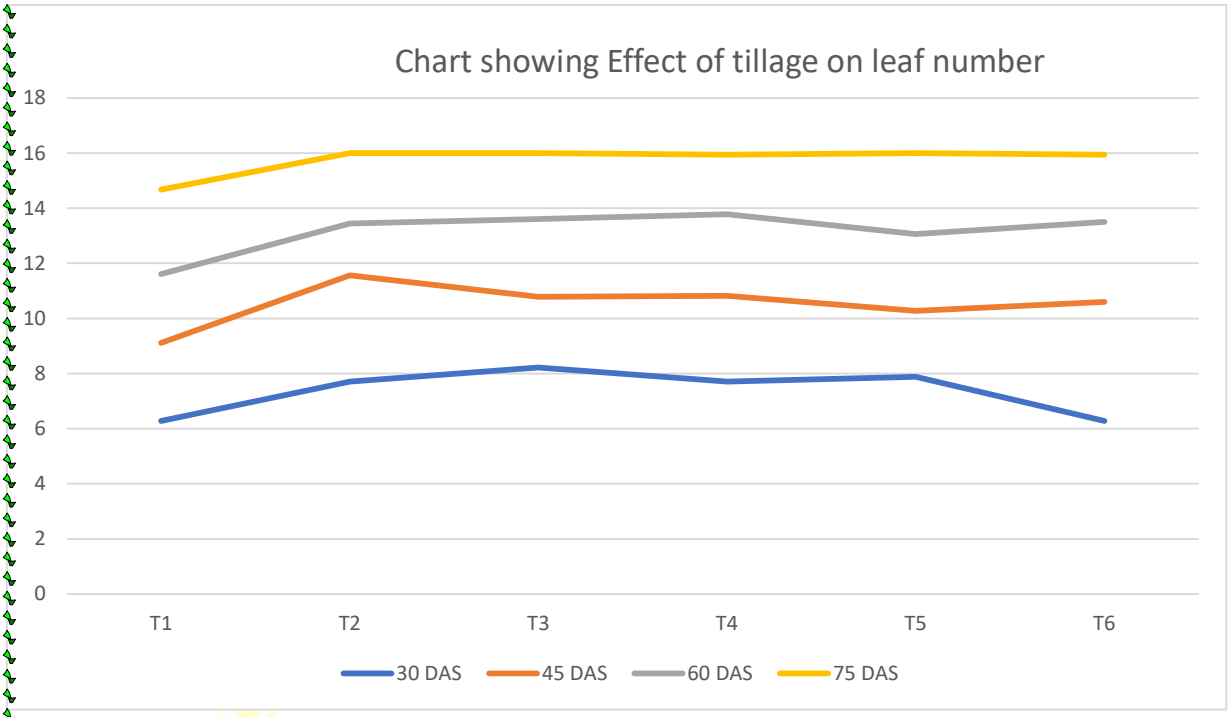

Figure 3. chart showing effect of different tillage on leaf number of maize

Effect of tillage on Leaf area index

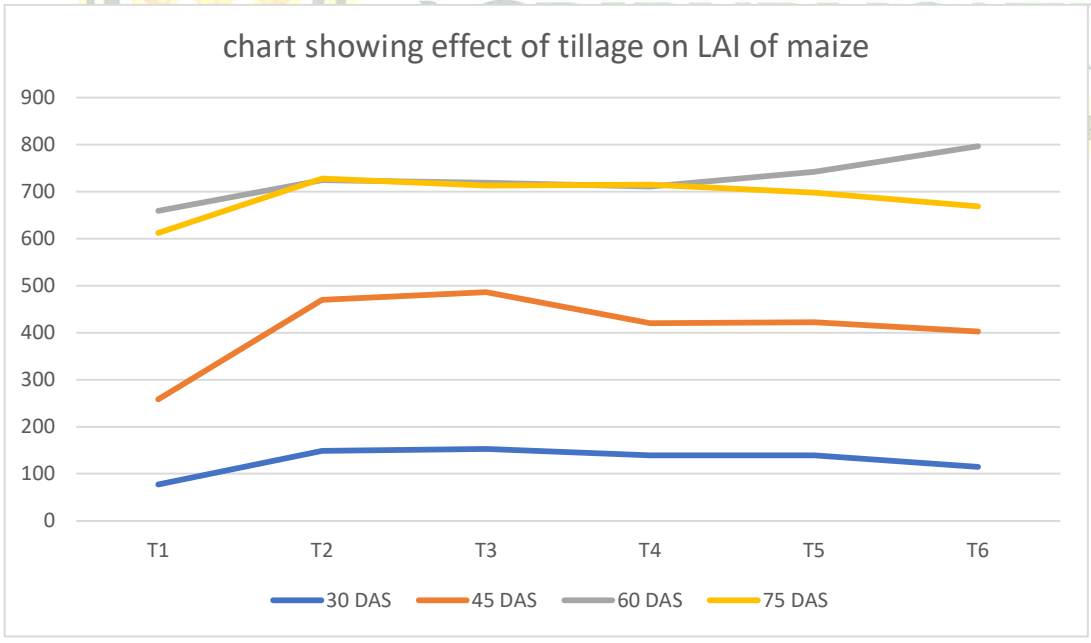

Figure 4. chart showing effect of different tillage on Leaf area index of maize

During the first 30 days after sowing, T3 demonstrated superior performance compared to other treatments, while T2 and T4 were statistically similar to T1. By 45 days, greater variation in performance was observed, with T3 maintaining the highest performance and zero tillage continuing to show the lowest. At 60 days after sowing, the mulch tillage treatment (T6) outperformed the other treatments, showing the highest

performance, while zero tillage continued to lag with the lowest performance. The other treatments were statistically similar to each other, following T6. Even at 75 days after sowing, zero tillage remained the lowest-performing treatment. Traditional spade tillage showed the highest leaf area index (LAI) among treatments, with the others being statistically comparable to it. Leaf area index varied extensively when maize hybrid was sown under various tillage systems. Maximum LAI was recorded under deep tillage while minimum in minimum tillage. Leaf area index was continued to increase while decreased towards maturity. The results were much better in conventional tillage than zero till.(Anjum et al., 2014). Higher LAI was observed in Conventional tillage than Zero tillage across the time series. LAI was increased from knee high stage (30 DAS) up to (60 DAS) and rate of increase decreases at (75 DAS) which was similar to the result of (Khatri et al., 2014)

Effect of tillage on Root length

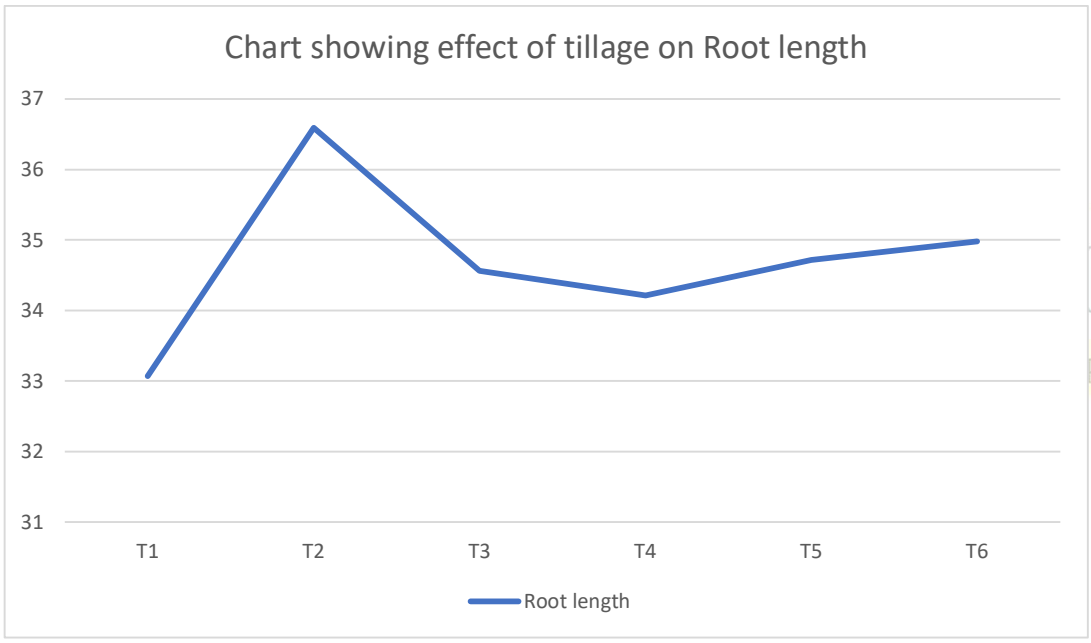

Figure 5. chart showing effect of different tillage on root length of maize

Spade till showed higher performance and zero till showed lowest performance followed by rotary till. Mulch till showed second highest root length. But, they are statistically similar but numerically different. Root length is an important consideration made in tillage operation. The above figure 6 shows conventional spade till to have higher root length insignificantly to other till methods. As spade till open up more depth for maize for better root growth. Machine tillage were also seen effective compared to zero till as they open up more space for root development.(Khusairy et al., 2006.)These results were in agreement with those who found that root length density lower in no-tillage than conventional tillage. (Chen & Weil, 2011)

Effect of tillage on Days to tasseling

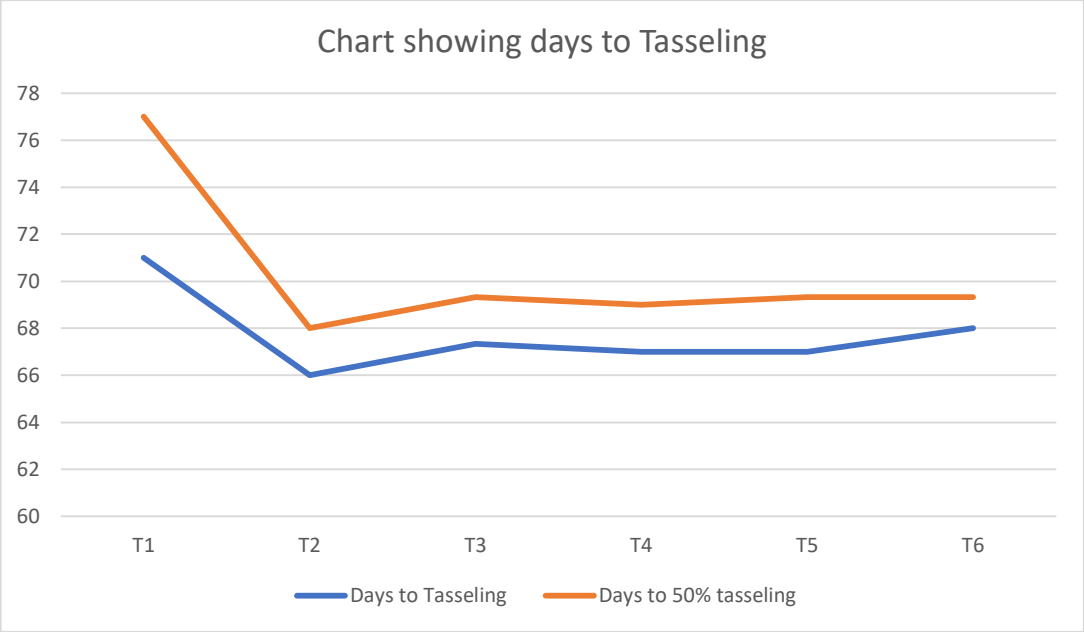

Figure 6. chart showing effect of different tillage on days to tasseling in maize

Tasselling was seen earlier on spade till at 66th days after sowing whereas on zero till it was later seen on 71th days after sowing. After T2, T5, T4 and T3 followed flowering at 67th, 67th, and 67.33th days after sowing respectively. Data regarding days to 50% tasseling indicates that there were no significant differences in days to 50% tasseling when maize was sown under different tillage practices except for zero till which was of higher number of days compared to others. Maximum days to 50% tasseling (77 days) were observed from zero tillage while minimum days to 50% tasseling (68 days) were recorded in deep-spade tillage which did differ significantly. This result differs with result of (Anjum et al., 2014) where no significant difference was seen under various tillage practice.

CONCLUSION

In conclusion, tillage practices play a crucial role in maize production, influencing soil health, water management, and crop yield. Majority of growth attributing characters were statistically similar in all tillage practices except, zero tillage. Rotary tillage demonstrated superior result on yield and yield attributing characters including thousand grain weight, Kernel per row, cob weight which was at par with spade and zero tillage in majority of cases. In mid-hill region where soil is prone to higher erosion, compaction and nutrient loss. The choice of tillage method should be specific to environmental conditions, soil types, and management goals, making it an essential consideration for sustainable maize production.

The research above demonstrated, use of different tillage practices and their effect on growth and yield of maize and it was concluded that rotary till gave higher grain yield which was at par with spade and zero

tillage. As, various growth parameters were lower and even took longer time for tasseling in Zero tillage, the study recommended that for optimum maize production, rotary tillage or spade tillage should be done before seeding.

RECOMMENDATIONS

From the above study, it was seen that Rotary till and spade till are more appropriate tillage method for summer maize. So, they are recommended for optimum maize production. Financial analysis should also be carried out to ensure best tillage practice in terms of cost and time consumption. Further research should be carried out on different varieties for verification of superiority of different tillage practices.

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