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Assessing the integrated impact of tillage and weed control methods on weed dynamics and management in maize (*Zea mays*)

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Abstract
A field experiment was conducted during rabi season of 2023-24 on loamy sand of in the rural area of Kanpur district of Mandhana, located 10 km from Kanpur in Uttar Pradesh to Assessing the Integrated Impact of Tillage and Weed Control Methods on Weed Dynamics and Management in Maize (*Zea mays*). The soil was normal in pH of 7.60, electrical conductivity (EC) of 0.25 dSm^{-1}, organic carbon content of 0.44%, and available nutrients including nitrogen (N), phosphorus (P), and potassium (K) at levels of 216.30, 19.15, and 149.10 kg ha^{-1}, respectively. The experiment was laid out during Kharif season of 2023-24. The experiment consisted of 12 treatment combinations (3Main plots Tillage methods, 4 Sub-plots Weed control methods) was laid out in Split Plot Design (SPD) with three replications.

Keywords: Tillage, weeds, maize

Introduction
One of the most significant crops grown in India during the Kharif season is maize, which is produced annually on 0.7 million hectares of land (Anonymous, 2023) [1]. a. Of the 420.22 thousand hectares under Kharif cereals in Himachal Pradesh, maize accounts for the largest portion (301.28 thousand hectares), followed by wheat (366.52 thousand hectares) (Anonymous, 2023) [2]. b. It has the highest production (768.20 thousand tonnes) of all the cereals in Himachal Pradesh due to the C4 physiological mechanism and the hospitable climate that supports its growth and development. Its average productivity of 2550 kg/ha is higher than the national average of 2114 kg/ha (Anonymous, 2023) [1]. Nonetheless, there is still a lot of room for improvement because this productivity is far below the achievable potential.

The primary reason for not realizing the crop's potential in the Himachal Pradesh mid-hills subhumid zone—where weed growth is most favored—is thought to be the intense competition this crop faces from a variety of weeds (Singh *et al*., 2018) [3]. If weeds are not controlled efficiently and in a timely manner, the intense competition they cause will result in a significant reduction in yield. According to Singh *et al*. (2016) [4] and Pandey *et al*. (2021) [5], weeds reduced the grain yield of maize in Palampur and Uttranchal by an average of 50–60 and 30-95 percent, respectively.

For hill farmers, who have been fighting the weed threat in maize primarily with handweeding and hoeing, weed management has been crucial. However, these manual techniques are time-consuming, labor-intensive, and labor-intensive. Therefore, applying pre-emergence herbicides is the best option to reduce weed competition from the beginning. To control weeds in this crop, atrazine, a pre-emergence herbicide, is currently advised. However, due to the limited range of weed control and the potential for herbicide resistance to arise from widespread and ongoing atrazine use (Holt and LeBaron, 1990) [6].

Effective weed control methods must be carefully chosen, integrated, and implemented while taking the sociological, ecological, and economic effects into account (Buchanan, 1976). Production techniques such as raised seed beds and zero-tillage techniques encourage crop growth in a way that maximizes crop competition with weeds. Tillage and weed control

techniques must therefore be combined (Burnside, 2016 and Lal, 2018) [7, 8]. Through the alteration of the environment by various tillage systems that favor the life cycle of certain weeds over others, tillage influences the vertical distribution of weed seeds in the soil layer, affecting weed seed germination rates, survival of weeds, and efficacy of weed control tactics. This has an impact on weed population dynamics. (Buhler, 2015) [9]. Therefore, a key component of the experiment is the analysis of weed dynamics in various tillage systems. Using tools to agitate the soil in order to eliminate weeds and improve tilth is known as tillage. Tillage operations cost, on average, about 30% of the total cost of crop production (Singh *et al*., 2002). It is now possible to grow successful crops without manipulating the soil thanks to significant advancements in tillage, seeding equipment, and herbicide technology. However, resolving the crucial problem of weed management is essential to the success of zero tillage (Gebhardt *et al*., 2015) [10].

In addition to its advantageous effects of minimizing lodging under high rainfall situations and reducing nutrient leaching, raised seed bed options with precise herbicide treatment can also provide a favorable soil environment for crop emergence, early growth, and higher productivity through better water relation and weed control in both poorly drained and moderately well drained soils (Hatfield *et al*., 2018) [11].

Material and methods

A field experiment was conducted during rabi season of 2022-23 on loamy sand of in the rural area of Kanpur district of Mandhana, located 10 km from Kanpur in Uttar Pradesh Assessing the Integrated Impact of Tillage and Weed Control Methods on Weed Dynamics and Management in Maize (*Zea mays*). The soil's pH was 7.60, electrical conductivity (EC) was 0.25 dSm^{-1}, organic carbon content was 0.44%, and the levels of available nutrients, such as potassium (K), phosphorus (P), and nitrogen (N), were 149.10 kg ha^{-1}, 19.15 kg ha^{-1}, and 216.30 kg ha^{-1}, respectively. The Rabi season of 2023–2024 is when the experiment was set up. The Kharif season of 2023–2024 is when the experiment was set up.There were twelve treatment combinations in the experiment (three main plots). Split Plot Design (SPD) was used to lay out the tillage techniques, four sub-plots, and weed control techniques with three replications. principal storylines Tillage techniques Raised seed beds, zero tillage, and conventional tillage Subplots Techniques for controlling weeds Not weeded, Data were collected on five selected plants from each plot regarding the pre-emergence levels of atrazine (1.50 kg/ha), acetachlor (0.75 kg/ha), and acetachlor 1.25 kg/ha.

Results and Discussion

Yield & yield attributes

Number of cob per rows

The Atrazine 1.5 kg/ha, which is statistically comparable to acetachlor 1.25 kg/ha, was one of the herbicides that led to significantly higher values of the different yield-contributing characteristics of the maize crop. However, acetachlor 0.75 kg/ha increased the number of rows per cob of maize in a statistically comparable manner to these two treatments, these show the significant interaction between tillage and weed control methods on cob length and number of rows per cob. Nonetheless, in plots treated with 1.5 kg/ha of atrazine, zero tillage was statistically equivalent to the other tillage techniques.

The use of raised or conventional seed beds combined with either 1.25 kg/ha of acetachlor or 1.5 kg/ha of atrazine, which are statistically equivalent, led to significantly longer cobs in both years. Nevertheless, the statistical comparison of the zero tillage and 1.5 kg/ha atrazine combination was also comparable to better ones. In contrast, it was statistically comparable to all superior combinations, with the exception of integrating conventional tillage with 1.25 kg/ha of acetachlor.

The tillage and weed control techniques worked together to significantly affect the number of grain rows per cob. Examining the information in showed that, with the exception of acetachlor 1.25 kg/ha, all weed control interventions. But when it came to significantly increasing the number of rows per cob in all weed control techniques—aside from unweeded check and in plots treated with atrazine at a rate of 1.5 kg/ha—zero tillage was also statistically similar to the other tillage methods.

Grain yield

All of the weed control techniques greatly increased the grain yield of maize when compared to an unweeded check. During, the most effective weed control methods were atrazine 1.5 kg/ha and acetachlor 1.25 kg/ha, which were statistically comparable in producing a significantly higher maize grain yield.

The maize grain yield was greatly influenced by the interaction between the tillage and weed control techniques. The data showed that, atrazine 1.5 kg/ha, which was statistically equivalent to acetachlor 1.25 kg/ha, produced a significantly higher grain yield compared to the other weed control methods in each of the tillage methods. The least effective tillage technique was acetachlor, at 0.75 kg/ha.

Stover yield

The data also showed that, when compared to an unweeded control, the stover yield of maize increased dramatically in all herbicide treatments. The herbicide atrazine at 1.5 kg/ha produced the highest stover yield of maize by a significant margin. On the other hand, acetachlor 1.25 kg/ha also produced a statistically similar amount of maize stover yield.

the interaction data between tillage and weed control methods on maize stover yield. These data show that for all weed control methods, conventional tillage, which is statistically equivalent to raised seed bed, produced significantly higher stover yield compared to zero tillage. However, when weeds were controlled with atrazine 1.5 kg/ha or acetachlor 1.25 kg/ha, zero tillage was also statistically similar to raised seed bed and conventional tillage in increasing the stover yield of maize. In plots treated with 1.5 kg/ha of atrazine, zero tillage was statistically similar to raised seed beds.

Biological yield

The data also showed that atrazine, at 1.5 kg/ha, was the next best weed control treatment. A critical examination of the interaction data shown, conventional tillage and raised seed beds, which are statistically comparable to one another, produced a significantly higher biological yield of maize compared to zero tillage. However, zero tillage was just as effective as conventional tillage and raised seed bed in increasing stover yield in plots treated with atrazine 1.5 kg/ha and acetachlor 1.25 kg/ha.With atrazine 1.5 kg/ha being statistically equivalent to acetachlor in all tillage techniques During, there was a significant increase in the biological yield of maize of 1.25 kg/ha. The next treatment that considerably raised the biological yield over unweeded check was acetachlor 0.75 kg/ha.

Harvest index

A critical analysis of the data in shows that, in experimentation,

weed control techniques and tim lage had no discernible impact on the harvest index.

Table 1: Integrated effect of tillage and weed control methods on length of cob (cm) of maize

Tillage methods	Weed control methods			
	Unweeded	Acetachlor 0.75 kg/ha	Acetachlor 1.25 kg/ha	Atrazine 1.5 kg/ha
Zero	10.60	12.57	13.67	15.30
Conventional	12.83	14.77	15.60	16.03
Raised seed bed	13.10	13.90	15.93	15.37
SE(m)	0.46	0.55	0.84	0.63
CD	o.96	1.15	1.44	1.19

Table 2: Integrated effect of tillage and weed control methods on number of rows per cob of maize

Tillage methods	Weed control methods			
	Unweeded	Acetachlor 0.75 kg/ha	Acetachlor 1.25 kg/ha	Atrazine 1.5 kg/ha
Zero	10.33	14.93	15.60	16.27
Conventional	13.60	16.00	16.93	17.07
Raised seed bed	14.93	16.13	15.87	16.40
SE(m)	0.82	1.71	0.41	0.86
CD	1.05	192	0.56	1.01

Table 3: Integrated effect of tillage and weed control methods on grain yield (kg/ha) of maize

Tillage methods	Weed control methods			
	Unweeded	Acetachlor 0.75 kg/ha	Acetachlor 1.25 kg/ha	Atrazine 1.5 kg/ha
Zero	3316.23	5771.45	7200.23	7161.29
Conventional	5115.66	6812.98	7662.92	7896.73
Raised seed bed	4705.40	6513.99	7718.95	7564.52
SE(m)	257.08	539.88	238.42	500.68
CD	267.13	521.34	346.61	616.63

Table 4: Integrated effect of tillage and weed control methods on stover yield (kg/ha) of maize

Tillage methods	Weed control methods			
	Unweeded	Acetachlor 0.75 kg/ha	Acetachlor 1.25 kg/ha	Atrazine 1.5 kg/ha
Zero	7036.22	12121.77	15571.06	15805.18
Conventional	10826.77	14555.41	16404.15	17001.98
Raised seed bed	9913.01	13909.93	16422.99	16232.71
SE(m)	620.09	1302.18	483.88	1016.14
CD	893.09	1591.91	512.78	993.91

Table 5: Integrated effect of tillage and weed control methods on biological yield (kg/ha) of maize crop

Tillage methods	Weed control methods			
	Unweeded	Acetachlor 0.75 kg/ha	Acetachlor 1.25 kg/ha	Atrazine 1.5 kg/ha
Zero	10352.45	17893.22	22771.29	22966.47
Conventional	15942.44	21368.38	24067.06	24898.72
Raised seed bed	14618.41	21473.92	24141.94	23797.23
SE(m)	844. 11	1772.62	627.10	1316.91
CD	1081.62	1980.83	708.91	1345.22

Conclusion

With an average weed control efficiency of more than 82%, raised seed beds combined with pre-emergence applications of atrazine 1.5 kg/ha or acetachlor 1.25 kg/ha were statistically comparable to a combination of conventional tillage and atrazine 1.5 kg/ha (pre) in controlling grasses and total weeds. With an average weed control efficiency of more than 72%, the comaenia benghallensis was successfully controlled using either zero tillage or conventional tillage in combination with atrazine 1.5 kg/ha or acetachlor 1.25 kg/ha. Raised seed beds or traditional tillage combined with atrazine 1.5 kg/ha or acetachlor 1.25 kg/ha (pre) greatly enhanced maize growth, yield characteristics, and grain yield.

References

1. Anonymous. Fertilizer statistics 2003-04. The Fertilizer Association of India, New Delhi. 2023a. p. 1-273.
2. Anonymous. Tenth five year plan (2002-2007) and annual plan (2003-2004). Planning Department, Government of Himachal Pradesh, Shimla. 2023b. p. GN III: 53-54.
3. Singh SJ, Sinha KK, Pandey IB. Weed management practices in maize based cropping sequence. J Res Birsa Agric Univ. 2018;10(2):145-8.
4. Singh CM, Angiras NN, Suresh Kumar. Weed Management. New Delhi: M.D. Publications; 2016. p. 49.
5. Pandey AK, Prakash V, Singh RD, Mani VP. Integrated weed management in maize. Indian J Agron. 2021;46:260-5.
6. Holt JS, LeBaron HM. Significance and distribution of herbicide resistance. Weed Technol. 1990;4:141-9.
7. Burnside OC. Soybean growth as affected by weed removal, cultivar and row spacing. Weed Sci. 2016;27:562-5.
8. Lal R. Tillage and agricultural sustainability. Soil Tillage Res. 2018;20:133-46.
9. Buhler DD. Influence of tillage systems on weed population dynamics and management in corn and soybean in the control USA. Crop Sci. 2015;35:1247-58.
10. Gebhardt MD, Daniel TC, Schweizer EE, Allmaras RR. Conservation tillage. Science. 2015;230:625-30.
11. Hatfield JL, Allmaras RR, Rehm GW, Lowery B, Allmaras RR, Anderson JL. Ridge tillage for corn and soybean production: environmental quality impacts. Soil Tillage Res. 2018;48:145-54.