Eco. Env. & Cons. 29 (October Suppl. Issue) : 2023; pp. (S260-S264)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i05s.045

Effect of cereals and pulses crop residue management on growth and productivity of maize (*Zea mays* L.)

Sourabh Singh and Santosh Korav

Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara, Jalandhar 144 411, India

(Received 27 April, 2023; Accepted 2 June, 2023)

ABSTRACT

In India, generally intensive agriculture performed and is a very serious cause of soil degradation and bad effect showing on food quality as well as humans health and animals. Intensive maize (*Zea mays* L.) cropping based on conventional tillage practices has resulted in soil quality degradation in the Punjab (India). The residue management also improved soil properties viz., pH, electrical conductivity, organic carbon. Results show that crop residue management practices with varying nitrogen doses significantly improved crop growth and productivity as compared to without residue. Plant height and no. of leaves were maximum in pulse residue incorporation with 125% RDN. Similarly, significantly maximum yield attributes like cob length (17.89cm), Number of cobs plant^{-1} (1.45) Shelling percent (75.22%) and Grain yield (6.15 t ha^{-1}), of maize were found in pulse residue incorporation with 125% RDN compared to overall cereal residue retention and incorporation and without residue. Residue management had significant influence on growth and productivity of maize to maintain the sustainable environment.

Key words: *Pulse residue, Cereal residue, Nitrogen, Yield, Incorporation, Retention*

Introduction

A lot of studies are reported application of nitrogen is more according to the recommended doses applied in conventional farming and this is the serious disease for soil fertility and food quality and excessive use of resources and productivity of crop also consider goes down but a moment crop also showing good result but after continuously use of conventional tillage that common days productivity also decreased (Mercy *et al*., 2012). But in many research crop residue application with combination of different doses of nitrogen showed positive responce to enhance the yield as well as soil properties due to decomposition of residue and increases the status of fertility in soil and residual practices a wonderful for sustainability because its also consumed the toxic element in soil and balanced chemical properties in soil (Mehta *et al*. (2011). The impact of varying doses of nitrogen and crop residues management associated with soil health and quality by improving soil properties, improving growth of crop, greatly effect on yield and conserving soil moisture is well documented. Hence residual practice reduced tillage cost of cultivation of maize and last few years widely used of synthetic fertilizer and as well as pesticide in conventional tillage and its operated potential to reduce production/ operating high costs and overcome benefit for the environment in conventional farming (Al-Kaisi and Yin, 2004).

However, growth of maize in traditional farming associated yearly low to low due to poor management of nutrient and excessive doses of synthetic

fertilizer and no addition of residue, green manuring, organic manure and these are cause of productivity is less day by day in any crop. A Many researchers reported that maize growth and yield were depends on nitrogen doses in traditional tillage system. But most of research shown a great variability in maize growth and yield by the practices of residual management with the combination of varying doses of nitrogen. crop residue application also enhanced the microbial population in soil and decomposition of crop residue also enhanced the nutrient status as well balance the soil properties (Shuaibu *et al.,* 2015). In this experimental area lot of information lacking on nutritional status and soil biological health. Hence the research was planned to understand the effect of various crop residue on growth and productivity of maize in north western plain zone of India.

Materials and Methods

The experiment was conducted at the fields of Lovely Professional University, Department of Agronomy, Lovely Professional University, Jalandhar (Punjab) during the year 2021-22. This field is situated at 310 22'31.81 North Latitude and 750 23'03.02 East longitude, with an average elevation and with a mean sea level of 252m. The soil was dug to a depth of 0-15 cm, collected for physical, chemical, and biological qualities. The experimental site has a high percentage of sand (77%) and is classified as sandy loamy soil. The field was laid out in random block design with 3 replication and 9 treatments. They are T_1: cereal residue + Residue retention + 100% RDN, T_2: Cereal residue + Residue retention + 125% RDN ,T_3: Cereal residue + Residue incorporation + 100% RDN, T_4: Cereal residue + Residue incorporation + 125% RDN, T_5: Pulse residue + Residue retention + 100% RDN, T_6: Pulse residue + Residue retention + 125% RDN, T_7: Pulse residue + Residue incorporation + 100% RDN, $T_{8;}$ Pulse residue + Residue incorporation + 125% RDN, T_9: Control with a gross plot size of 5.0 x 4.0 m and in all the plot bulk maize crop (variety PMH 13) was raised and cultivation practices followed as per POP PAU Punjab. Data on different aspects of maize crop were subjected to statistical analysis as per the procedure of RBD. The value of CD was worked out and compared with the value of table at 5 per cent level of significance. The values of SE(m) and CD% along with critical difference values were also calculated for all parameters.

Results and Discussion

Plant height and no of leaves per plant

Effect of crop residue and nitrogen management significantly influenced on plant height of maize during 2022 (Table 1). Pulse residue better performer than cereal residues under 100 and 125% of nitrogen doses. Pulse residue incorporation with 125% of N applied plots superior over cereal residue incorporation and retention on the surface of the soil. Maximum plant height was found in Pulse residue incorporation with 125% N application at 30 (70.37cm),

Table 1. Plant height (cm) and number of leaves at different growth stage of maize as influenced by pulse, cereal residue management with incorporation and retention and nitrogen levels during *Kharif* 2022-23.

Treatment	2022-23					
	Plant height (cm)			Number of leaves (no.)		
	30 DAS	60 DAS	Maturity	30 DAS	60 DAS	Maturity
T1- cereal residue +retention + 100% RDN	56.33	175.83	197.48	3.33	9.90	8.74
T2- cereal residue +retention + 125% RDN	61.15	185.31	203.12	4.11	12.55	11.14
T3- cereal residue +incorporation + 100% RDN	59.38	180.75	199.94	4.07	11.19	10.30
T4- cereal residue +incorporation + 125% RDN	62.11	188.07	205.44	5.22	13.44	12.94
T5- Pulse residue+ retention + 100% RDN	57.61	179.07	198.67	3.98	10.28	9.27
T6- Pulse residue+ retention + 125% RDN	62.11	186.70	204.15	4.44	13.22	11.95
T7- Pulse residue+ incorporation + 100% RDN	60.15	182.22	200.84	4.08	11.89	10.22
T8- Pulse residue +incorporation + 125% RDN	70.37	191.21	206.68	6.23	14.89	13.11
T9 Control	50.33	157.74	174.67	3.33	6.67	6.00
C.D.	1.89	1.23	1.48	0.41	0.73	0.45
SE(m)	0.63	0.41	0.49	0.14	0.24	0.15

60, (191.21cm) and at maturity (206.68 cm). Lowest plant height was found in control. Similarly, effect of crop residue and nitrogen management significantly influenced on no of leaves per plant during 2022 (Table 1). Pulse residue better performer than cereal residues under 100 and 125% of nitrogen doses. Pulse residue incorporation with 125% of N applied plot superior over cereal residue incorporation and retention on the surface of the soil. Maximum no of leaves per plant was found in pulse residue incorporation with 125% N application at 30 DAS (6.23 no.), 60 DAS (14.89 no.) and at maturity (13.11 no). Lowest no of leaves was found in control

Incorporation of pulse residue with 125% nitrogen enhanced growth of plant height and number of leaves superior over cereal residue incorporation and retention with varying dose of nitrogen. This might be due to enhanced availability of nitrogen from decomposition of pulse residue. The decomposition of pulse residue might have created a positive effect on availability of nutrients to the succeeding maize crop, which resulted in enhanced plant height and number of leaves. The results were in agreement with the research findings of wolfe and Eckert (1999), Sujatha *et al*. (2008); Egbe and Ali (2010) and Shuaibu *et al*. (2015). Cereals residue have high C-N ratio leads to take more duration to decomposition. However, application of nitrogen with 125% accelerates decomposition process and supply nutrient to the crop.

Yield and yield attributes

Number of cob plant^{-1} and cob length

In this field experiment trial was conducted during 2022 (Table 2) in maize and main aim is management of crop residue and nitrogen with varying level. Two residues are used like pulse residue and cereal residue with incorporation and retention on the surface of the soil under 100 and 125% of nitrogen doses. Pulse residue incorporation with 125% of N applied plots superior over cereal residue incorporation and retention on the surface of the soil. Result was found pulse residue incorporation with 125% N application superior at harvesting stage and maximum no of cobs per plant was observed (1.45). Lowest cob was found in control. Similarly, result (Table 2) found in case of cob length pulse residue incorporation with 125% of N applied plots superior over cereal residue incorporation and retention on the surface of the soil. Result was found pulse residue incorporation with 125% N application superior and maximum cob length observed (17.89cm). Lowest cob length was found in control.

Higher value of number of cobs plant^{-1}was received in pulse residue incorporation with 125% RDN doses applied on plot. Secondly, increased level of nitrogen also enhanced the physiology of plant then also very positive effect on yield attributes. Similar result reported by Mercy *et al*. (2014) and Roshan *et al.* (2013). The pulse residue incorporation with 125% RDN might have increased

Table 2. Cob length (cm), Shelling (%), Grain yield (t ha^{-1}), Number of cobs plant^{-1} of maize as influenced by pulse, cereal residue management with incorporation and retention and nitrogen levels during *Kharif* 2022-23

Treatment	2022-23			
	Days after incorporation and retention of cereal and pulse residue			
	Number of cobs plant^{-1}	Cob length	Grain yield t ha^{-1}	Shelling percent (%)
T1- cereal residue +retention + 100% RDN	1.00	14.92	5.277	65.00
T2- cereal residue +retention + 125% RDN	1.00	16.11	5.947	72.38
T3- cereal residue +incorporation + 100% RDN	1.00	15.12	5.407	68.78
T4- cereal residue +incorporation + 125% RDN	1.22	17.54	6.01	74.00
T5- Pulse residue+ retention + 100% RDN	1.00	15.00	5.363	66.44
T6- Pulse residue+ retention + 125% RDN	1.00	16.51	5.977	72.66
T7- Pulse residue+ incorporation + 100% RDN	1.00	15.96	5.92	71.22
T8- Pulse residue +incorporation + 125% RDN	1.45	17.89	6.15	75.22
T9 Control	1.00	8.83	3	59.11
C.D.	0.24	0.14	0.119	0.62
SE(m)	0.08	0.05	0.039	0.21

the physical properties, biological properties and availability of nutrients leading to enhanced photosynthesis, better accumulation of dry matter and increased photosynthates translocation to the sink leading to development of healthy cobs. The experimental results are in compliance from findings of Arif *et al.* (2011) and Anup Das *et al.* (2016).

Grain yield and shelling percentage

Effect of crop residue and nitrogen management significantly influenced on grain yield of maize during 2022 (Table 2). Pulse residue better performer than cereal residues under 100 and 125% of nitrogen doses. Pulse residue incorporation with 125% of N applied plots superior over cereal residue incorporation and retention on the surface of the soil. Maximum grain yield was found in Pulse residue incorporation with 125% N application at observed (6.15t/ha). Lowest grain yield was found in control. Similarly, effect of crop residue and nitrogen management significantly influenced on shelling percentage during 2022 (Table 2). Pulse residue better performer than cereal residues under 100 and 125% of nitrogen doses. Pulse residue incorporation with 125% of N applied plot superior over cereal residue incorporation and retention on the surface of the soil. Maximum shelling percentage was found in pulse residue incorporation with 125% N application at observed (75.22%). Lowest shelling percentage was found in control.

The superiority of pulse residue incorporation with 125% RDN of higher yields in maize is mainly attributed to the higher biomass production which upon incorporation might have provided positive impact on soil fertility. This positive effect of soil fertility might have increased the availability of soil nitrogen. It might also be due to non-N rotational effects where there might have been increased availability of nutrients other than nitrogen through microbial activity, deep rooting and root exudates (Wani *et al*., 1991). The findings are in confirmity with the experimental results of Arthur Alfred (2009), Egbe and Ali (2010), Svubure *et al*. (2010), Talebbeigi and Ghadiri (2012). Fabunmi and Agbonlahor (2012) and Usman *et al.* (2013).

Conclusion

Crop growth and productivity of maize was increased with cereal and pulse residue retention and incorporation. Appropriate use of nitrogen dose reduced the loss and environmental toxicity. Application of 125% of RDN along with pulse residue incorporation before the sowing of maize is advisable to increase crop growth, productivity and soil properties. Also maintain sustainable environment.

References

Al-Kaisi, M.M. and Yin, X. 2004. Stepwise time response of corn yield and economic return to no tillage. *Soil and Tillage Research*. 78 : 91-101.

Anup Das, Manoj Kumar, Ramkrushna, G.I., Patel, D.P., Jayanta Layek, Naropongla, Panwar, A.S. and Nagchan, S.V. 2016. Wed management ni maize under rainfed organic farming system. *Indian Journal of Weed Science.* 48 (2): 168-172.

Arif, Md,. Mohammad Tariq Jan, Mohammad Jamal Khan, Muhammad Saeed, Iqbal Munir, Ziauddin, Habib Akbar, Shahenshah and Muhammad Zafarullah Khan, 2011. Effect of cropping system and residue management ni maize. *Pakistan Journal of Botany.* 34 (2): 915-920.

Arthur Alfred, 2009. *Efect of decomposing crop residues on soil properties and crop productivity in the semi-deciduous forest zone of Ghana.* Ph.D Thesis. Colege of Agriculture and Natural Resources, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Egbe, O.M. and Ali, A. 2010. Influence of soil incorporation of common food legume stover on the yield of maize in sandy soils of moist savanna woodland of Nigeria. *Agriculture and Biology Journal of North Americ*a. 1 (2): 156-162

Fabunmi, T.O. and Abgonlahor, M.U. 2012. The economics of maize production under differentcowpea-based green manure practices in the derived savanna zone of Nigeria. *Journal of Organic Systems*. 7(2): 5-13.

Harrington, L. 1996. Diversity by design: Conserving biological diversity through more productive and sustain agro ecosystems. CIMMYT Natural Resource Group, presented at Biodiversity and Sustainable Agriculture, a workshop by the Sweden Scientific Council: Ekenas, Sweden.

Hari Om, Singh, S.P., Singh, J.K., Singh, RN., Ansari, MA., Meena, R.L. and Brush Yadav, 2014. Productivity, nitrogen balance and economics of winter maize (*Zea mays*) as influenced by QPM cultivars and nitrogen levels. *Indian Journal of Agricultural Sciences.* 84 (2): 306-308.

International federation of organic agriculture movements report of 2022.

Mehta, S., Seema, Bedi and Krishan Kumar Vashist, 2011. Performance of winter maize (*Zea mays*) hybrid to planting methods and nitrogen levels. *Indian Journal of Agricultural Sciences*. 81 (1): 50-54.

Mercy, Z., Chandrasekhar, K. and Subbaiah, G. 2012. Response of maize (*Zea mays*) to planting densities and nitrogen levels under late rabi conditions. *The Andhra Agricultural Journal*. 59 (4): 517-519.

Owla, M.L., Nepalia, V., Chouhan, G.S. and Dilip Singh, 2015. Efect of fertility levels, nutrient sources and weed control on weed dynamics and yield of quality protein (*Zea mays*) and relative nitrogen and phosphorus uptake. *Indian Journal of Agronomy*. 60 (2): 267-272.

Package and practices of Punjab Agriculture University 2019- 2020.

Roshan, C. Singh, N. and Nepalia, V. 2013. Productivity and economics of quality protein maize (*Zea mays*) as influenced yb nitrogen levels, its scheduling and sulphur application. *Indian Journal of Agronomy*. 58 (3): 340-343.

Sujatha, M.G., Linga Raju, B.S., Paled, Y.B. and Ashalatha, K.V. 2008. Importance of integrated nutrient management practices in maize under rainfed conditions. *Karnataka Journal of Agricultural Sciences*. 2 (3): 334-338.

Shuaibu, Y.M., Garba, A.A. and Voncir, V. 2015. Influence of legume residue and nitrogen fertilizer on hte growthand yield ofsorghum (*Sorghum bicolor* L. Monech) ni Bauchi satet, Nigeria. *African Journal fo Food, Agriculture, Nutrition and Development*. 51 (3): 10060-10076.

Svubure, O., Sheunesu Mpepereki and Fred Makonese, 2010. Sustainability of maize-based cropping systems ni rural areas of Zimbabwe: An assessment of theresidualsoil fertility effects of grain legumes on maize (*Zea mays* L.) under field conditions. *International Journal of Engineering science and Technology*. 2(7): 141-148.

Tiscareño, M., Báez-González, A.D., Velásquez-Valle, M., Potter, K.N., Stone, J.J., Tapia-Vargas, M. and Claverán-Alonso, R. 1999. Agricultural research for watershed restoration in central México. *J. Soil Water Conserv.* 54: 686–692.

Talebbeigi, R.M. and Ghadiri, H. 2012. Efects ofcowpea living mulch on weed control and maize yield. *Journal of Biological and Environmental Sciences*. 6 (17): 189-193.

Usman, A., Osunde, A.O. and Bala, A. 2013. Nitrogen contribution of some selected legumes to a sorghum based cropping system ni the southern Guinea savanna of Nigeria. *African Journal ofAgricultural Research.* 8 (49) : 6446-6456.

Venkata Rao, P., Subbaiah. G., Veeraraghavaiah, R., Ashoka Rani, Y. and Srinivasa Rao, V. 2014. Effect ofplanting densities and nitrogen levels on productivity and economics of rice fallow maize (*Zea mavs*) under zero tillage conditions. *The Andhra Agricultural Journal*. 61(1): 6-12.

Wolfe, M.A. and Eckert, J.D. 1999. Crop sequence and surface residue effects on the performance of no-till corn grown on a poorly drained soil. *Agronomy Journal*. 91: 363-367.

Wani, S.P., Mc Gil, W.B. and Tewari, J.P. 191. Mycorrhizal and common root infection and nutrient accumulation ni barley grown on Breton loam using N from biological fixation or fertilizer. *Biology and Fertility of Soils*. 12: 46-54.