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Response of *kharif* maize under different mulching and integrated nutrient management practices in eastern region of Uttar Pradesh

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Abstract
A field experiment was conducted in a split-plot design during the *kharif* seasons of 2017 at Varanasi, Uttar Pradesh, to evaluate the relative performance of different mulching, *viz*. M_1:control (no mulch), M_2:dust mulch and M_3:rice straw mulch and integrated nutrient management include S_1:100% RDF, S_2:75% RDF + 25% N through poultry manure, S_3: 100% RDF + 25% N through poultry manure, S_4: 75% RDF + 25% N through FYM and S_5**:** 100% RDF + 25% N through FYM on growth and yield *kharif* maize (*Zea maize* L.). The recommended dose of fertilizer (RDF) for rice was 120, 60 and 60 kg ha^{-1} of N, P_2O_5 and K_2O respectively. Various growth parameters and yield of maize showed significant variation under different mulching and integrated nutrient management practices. Among the mulching treatments, dust mulch significantly recorded number of leafs, plant height (cm), leaf area index at 75 DAS, chlorophyll content at 75 DAS (spad value), grain yield (q ha^{-1}) and stover yield (q ha^{-1}) of maize over control (no mulch) and it were at par with the rice straw mulch, respectively. Applications of integrated nutrient management practices were positively correlated with various growth parameters and yield of *kharif* maize. Among the integrated nutrient management, application of S3: 100% RDF + 25% N through poultry manure recorded significantly highest number of leafs, plant height (cm), leaf area index at 75 DAS, chlorophyll content at 75 DAS (spad value), grain yield (q ha^{-1}) and stover yield (q ha^{-1}) as compared to S2:75% RDF + 25% N through poultry manure, S4: 75% RDF + 25% N through FYM and S_5:100% RDF and it were at par with S_5: 100% RDF + 25% N through FYM, respectively

Keywords: Growth, integrated nutrient management, mulching, yield

Introduction
Maize is one of the most versatile crop, has the highest genetic yield potential and known as queen of cereals in the world. Maize is considered as the third most important food crop among the cereals in India that contributed to nearly 9% of the national food security. Maize is a stable food, and quality feed, and used as a basic raw material for thousands of industrial products. According to advance estimate its production is likely to be 18.89 M tonnes mainly during *Kharif* season which covers 80% area. Whereas, the average productivity in India is 2.43 t ha^{-1} (Anonymous, 2019) [1]. Maize cultivation is the major constraint for establishing a crop is the lack of adequate moisture in the seed zone (Hadda *et al*., 2000) [5]. Apart from this, the productivity of maize is also limited due to moisture stress (Rana *et al*., 2006) [11] and this could be achieved by soil and nutrient management practices as these are of paramount concern to conserve soil moisture, improve the productivity and fertility (Arora and Hadda, 2003) [2]. Therefore, the need for moisture conservation becomes an integral component to embark upon through following practice like mulching. Moisture conservation could be greatly increased by imposition of mulches on soil surface (Singh *et al*., 2014) [14]. Mulch particularly restricts the transport of water vapor from soil surface to microclimate, which diminish the direct evaporation loss of water (Yuan *et al.*, 2009) [15] and increases the availability of soil water to the crops resulted regulation of soil temperature (Ramakrishna *et al.*, 2006) [10]. The residues of mulches such as Jowar or bajara stubbles, paddy straw or husk, saw dust etc. left on the soil eliminates soil loss by preventing water and wind erosion and improves chemical, physical and biological properties of soil (Iqbal *et al.*, 2003) [7].

Maize being heavy feeder requires much more nutrients than compared to other crops and in order to meet those nutritional requirements the farmers are applying large quantities of inorganic fertilizers without understanding its negative impact in the fertility status of the soil as well as the concerned environment. Fertilizers are continuously use in intensive cropping system that is leading to imbalance of nutrients in soil, which has an adverse effect on soil health and crop yield. Integrated nutrient management is an option for maintain soil health and crop productivity. Integrated use of organic manures and fertilizers not only helps in maintaining the highest productivity but also provides stability in crop production. The supplementary and complementary use of organic manures, *viz*. farm yard manure, poultry manure, vermicompost, castor cake and inorganic fertilizers plays an important role in the growth (Roopashree *et al*., 2019) [12] and yield of crop (Choudhari and Channappagoudar, 2014) [3] and enhance the soil health (Sharma *et al*., 2013) [13].

Method and Materials

The field experiment was conducted during *kharif* seasons of 2017 at the Agricultural Research Farm of Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (25°18' N, 83°03' E and 128.9 m above mean sea-level), situated in the centre of north Gangetic alluvial plains. The experimental site has semi-arid to sub humid type of climate with moisture deficit index between 20 and 40%. The average annual rainfall at Varanasi is 1,100 mm and about 88% of it is received during June-September. Weather data of during crop experimentation shown in fig. 1. The soil was low (0.47%) in organic carbon (wet-digestion method) with slightly alkaline in reaction (pH 8.1). The available N (alkaline permanganate-oxidizable), P (0.5 M NaHCO3 -extractable), and K (1 M ammonium acetate-exchangeable K) were 137 (low), 20.6 (medium) and 136.8 (medium) kg ha^{-1} respectively. The experiment was laid out in a split-plot design, keeping mulching treatments in main plots and integrated nutrient management treatments in subplots, with 3 replications. Three main plots treatment were: M_1: Control (no mulch), M_2: Dust mulch and M_3: rice straw mulch. The subplot treatments were: S_1: 100% RDF, S_2: 75% RDF + 25% N through poultry manure, S_3: 100% RDF + 25% N through poultry manure, S_4: 75% RDF + 25% N through FYM and S_5: 100% RDF + 25% N through FYM where, RDF is 120: 60: 60 kg N: P_2O_5: K_2O ha^{-1} respectively; Maize cultivar 'K-99' was chosen for the experiment and was grown. Seed were sown in the main field with a spacing of 60cm × 20cm. Among the mulching treatments, rice straw mulch applied uniformly at the rate of 4 ton ha^{-1} over the field after the emergence of the plant and dust mulch include loosen surface soil by the use spade and *khurpi*. Entire amount of N, P and K were applied at the time of sowing as a basal dose. The N, P and K were applied through urea, single super phosphate (SSP) and muriate of potash (MoP), respectively. Besides, maize crop was raised with recommended package of practices under dryland condition. Well rotten poultry manure and FYM were taken from IFS (integrated farming system) and their chemical status shown in Table 1. It's were applied before 15 days of sowing. Observations on growth parameters, yield attributes and yield of maize were recorded and their significance was tested by the variance ratio (~F-value) at 5% level (Gomez and Gomez, 1984). Treatment means were compared using critical differences (CD) at the 5% level of significance. Relative economics was calculated as per the prevailing market prices of the inputs and produce during the years of experimentation.

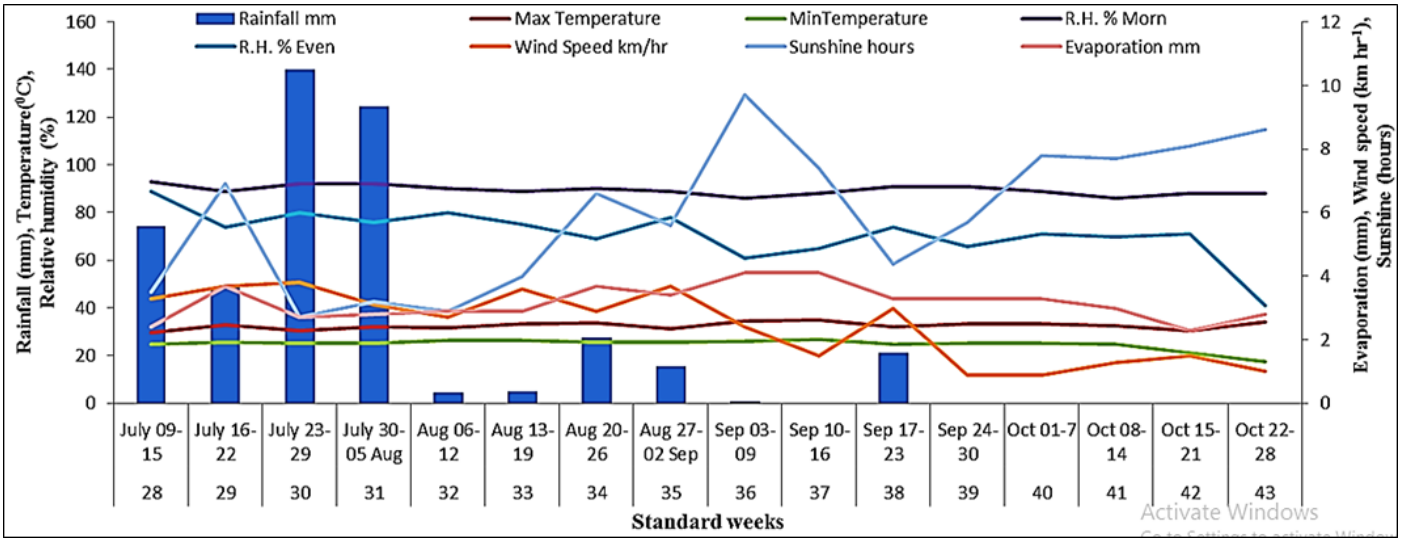

Fig 1: Weekly meteorological data recorded at B.H.U. Agriculture Farm during crop season *kharif* of 2017

Table 1: Chemical status of organic manures

Organic manures	Nitrogen content	Phosphorus content	Potassium content
FYM	0.48+0.0083	0.25+0.0011	0.48+0.0057
PM	2.97+0.018	0.99+0.0007	1.49+0.0020

Result and Discussion

Growth parameters

Mulching and integrated nutrient management showed significant variation on growth parameters of maize, *viz*. number of leafs, plant height, leaf area index and chlorophyll content during both the years of experimentation (Table 2, Fig. 2 and 3).

Maximum mean number of leafs, plant height, leaf area index and chlorophyll content was recorded under dust mulch, which was statistically at par with rice straw mulch and significantly superior over control (no mulch), respectively. Similar results also found by Rajput *et al.* (2014) [9].

Integrated nutrient management practices had significant influence on number of leafs, plant height, leaf area index and chlorophyll content. Application of 100% RDF + 25% N through poultry manure was recorded significantly number of

leafs, plant height, leaf area index and chlorophyll content over 75% RDF + 25% N through poultry manure, 75% RDF + 25% N through FYM, 100% RDF and it were statistically at par with 100% RDF + 25% N through FYM, respectively. The interaction effect between mulching and integrated nutrient management treatments on number of leafs, plant height, leaf area index and chlorophyll content was found to be non-significant. Similar findings were also reported by Iqbal *et al*. (2014) [6], who observed that application of application of 75% N from urea + 25% N from poultry manure recorded significantly highest plant height and number of leaves per plant observed.

Grain and stover yield

Significant variation in grain and stover yield caused by mulching and integrated nutrient management treatments (Table 2 and Fig. 4). Among mulching treatments, dust mulch recorded significantly the highest grain and stover yield over control (no mulch) and it was statistically at par with rice straw mulch. Rajput *et al.* (2014) [9] also reported similar effect of mulch.

It is evident from the data that integrated nutrient management treatments recorded significantly highest grain and stover yield over 100% RDF. Data further revealed that amongst integrated nutrient management practices, the highest grain and stover yield was recorded under 100% RDF + 25% N through poultry manure as compared to 75% RDF + 25% N through poultry manure, 75% RDF + 25% N through FYM, 100% RDF and it were at par with 100% RDF + 25% N through FYM, respectively. Our finding confirm the results of Choudhari and Channappagoudar (2014) [3]. Nagavani and Subbian (2014) [8] revealed that significant increase in grain and stover yield of hybrid maize were recorded with the application of 50% RDF through poultry manure + 50% RDF through inorganic fertilizers as compared to other treatments.

Table 2: Effect of mulching and integrated nutrient management on growth and yield of *kharif* maize

Treatment	Number of leafs	Plant height (cm)	Leaf area index at 75 DAS	Chlorophyll content at 75 DAS (spad value)	Grain yield (q ha^{-1})	Stover yield (q ha^{-1})
Mulching						
M_1: Control (No mulch)	7.54	190.0	3.72	39.7	39.48	83.74
M_2: Dust mulch	9.53	216.0	4.27	45.2	50.80	90.01
M_3: Rice straw mulch	8.97	206.1	4.16	42.2	49.80	89.05
S.Em±	0.38	4.8	0.10	1.0	1.07	1.16
CD (p=0.05)	1.48	18.9	0.41	3.8	4.18	4.55
Integrated nutrient management						
S_1:100% RDF	7.89	193.4	3.77	38.5	43.53	85.69
S_2: 75% RDF + 25% N through Poultry manure	8.62	201.8	4.10	42.3	45.63	87.08
S_3: 100% RDF + 25% N through Poultry manure	9.50	217.3	4.38	46.5	50.64	89.97
S_4: 75% RDF + 25% N through FYM	8.16	195.4	3.84	40.0	44.53	86.20
S_5: 100% RDF + 25% N through FYM	9.23	212.0	4.17	44.6	49.14	89.06
S.Em±	0.27	5.8	0.11	1.0	1.25	1.07
CD (p=0.05)	0.80	17.0	0.33	2.8	3.65	3.12

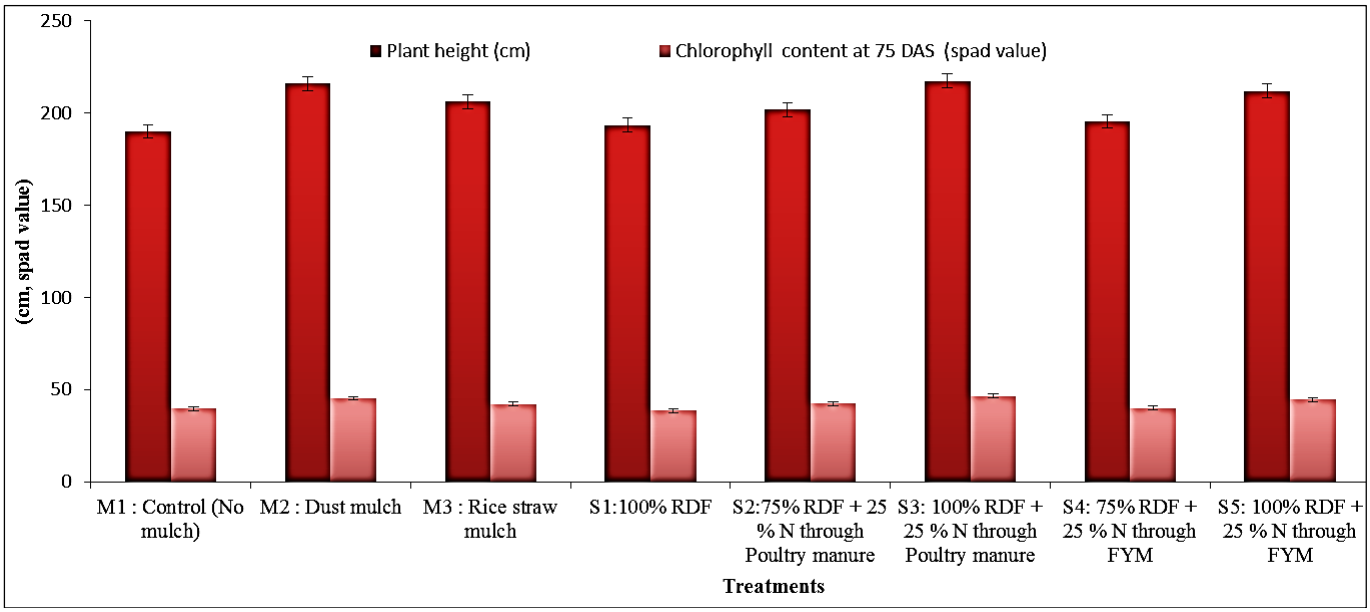

Fig 2: Effect of mulching and integrated nutrient management on plant height and chlorophyll content

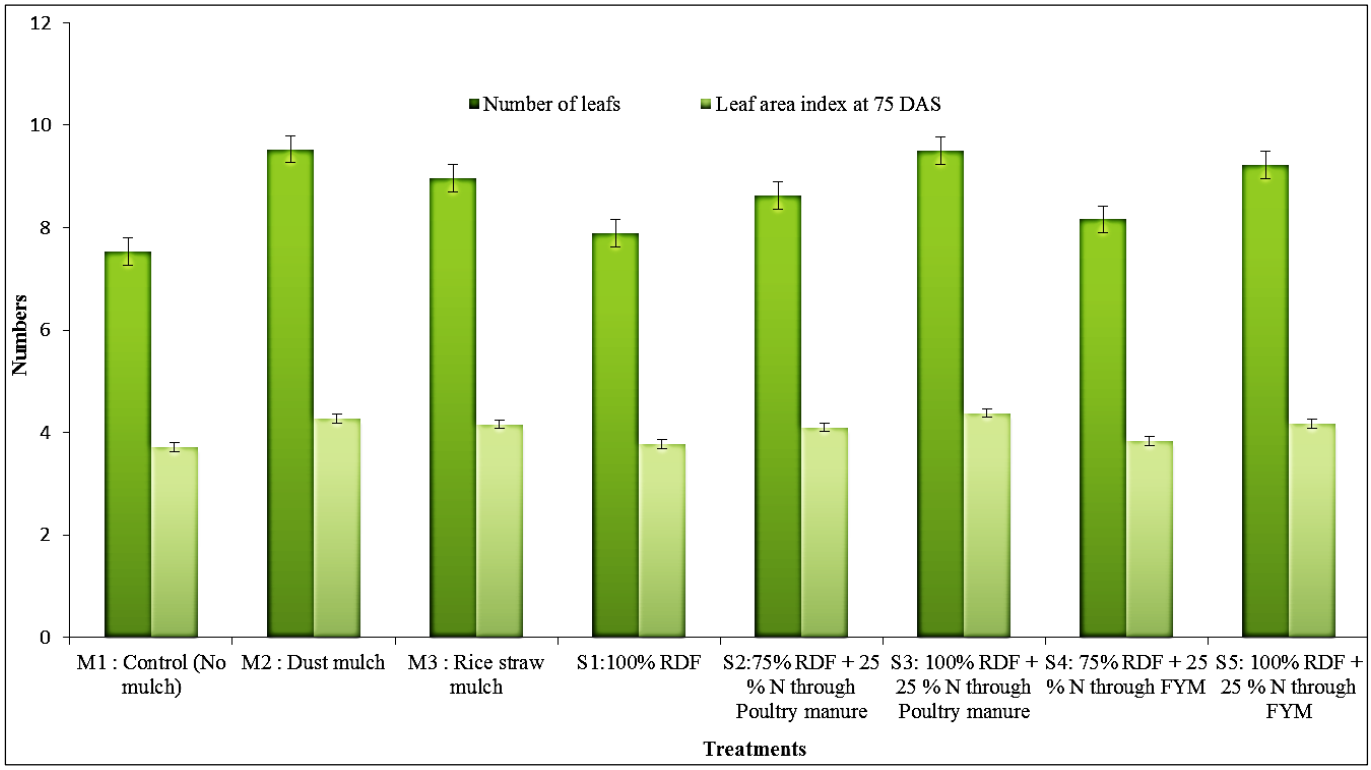

Fig 3: Effect of mulching and integrated nutrient management on number of leaf and leaf area index

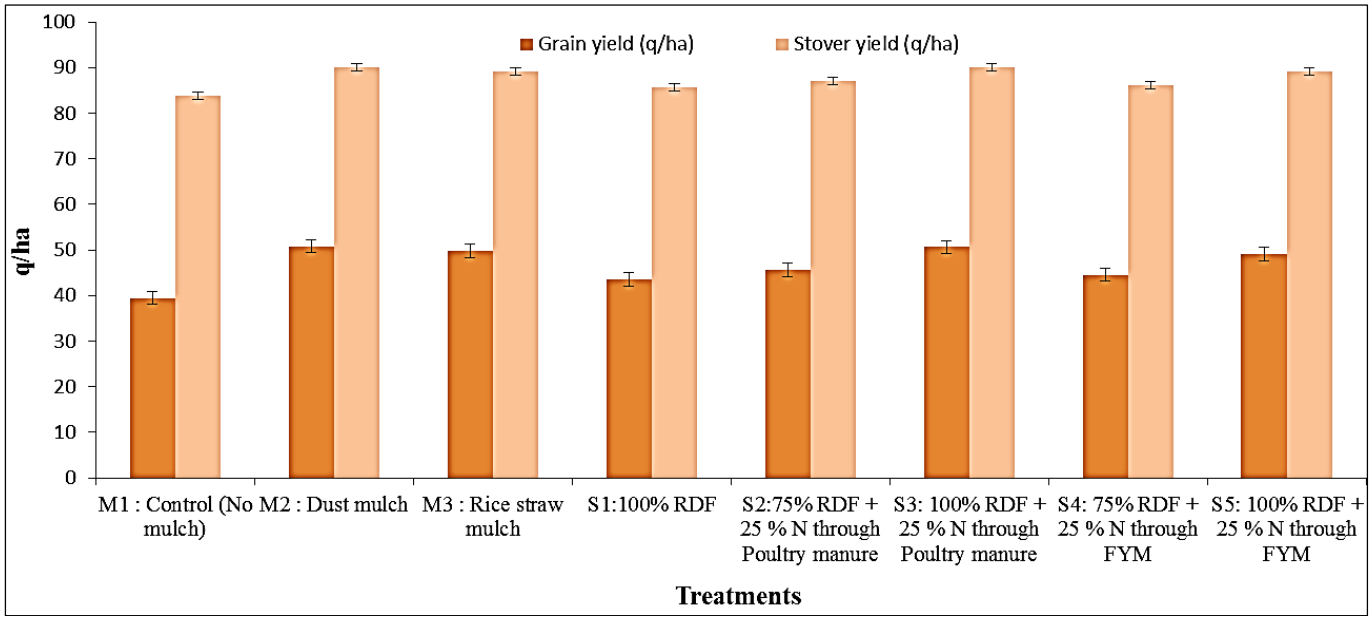

Fig 4: Effect of mulching and integrated nutrient management on grain and stover yield

Conclusion

Based on the experimentation, it can be concluded that mulching and integrated nutrient management treatments had pronounced effect on growth and yield *kharif* maize. Dust mulch application produced the highest yield and yield traits. Application of 100% RDF + 25% N through poultry manure practice proved to be higher growth and productivity than other recommended dose of fertilizers.

References

1. Anonymous. First advance estimates of production of food grains for 2019-20, Ministry of agriculture and farmer's welfare department of agriculture, cooperation and farmer's welfare, 2019. http://agricoop.gov.in/sites/default/files/Time-Series-1st-Adv-Estimate-2019-20-Final-Press.pdf.
2. Arora S, Hadda MS. Soil moisture conservation and nutrient management practices in maize-wheat cropping system in rain-fed North-western tract of India. Indian Journal of Dryland Agriculture Research and Development. 2003; 18:70-74.
3. Choudhari VV, Channappagoudar BB. Effect of organics on growth and morpho-physiological characters in maize (*Zea mays* L.). Karnataka Journal of Agricultural Sciences. 2014; 27(3):343-344.
4. Gomez AK, Gomez AA. Statistical Procedures of Agricultural Research. An IRRI Book, John Wiley and Sons, New York, 1983.

5. Hadda MS, Khera KL, Kukal SS. Soil and water conservation practices and soil productivity in North-Western sub-mountainous tract of India: A review. Indian Journal of Soil Conservations. 2000; 28:187-192.
6. Iqbal A, Iqbal MA, Raza A, Akbar N, Abbas RN, Khan HZ. Integrated nitrogen management studies in forage maize. American-Eurasian Journal Agricultural and Environment Science. 2014; 14(8):744-747.
7. Iqbal MA, Hassan AU, Hussain A. Effect of mulch, irrigation and soil type on biomass and water use efficiency of forage maize. Pakistan Journal of Agriculture Science. 2003; 40:3-4.
8. Nagavani AV, Subbian P. Productivity and economics of maize as influenced by integrated nutrient management. Current Biotica. 2014; 7(4):283-293.
9. Rajput BS, Maurya SK, Singh RN, Sen A, Singh RK. Effect of different types of mulch on maize under guava (*Psidium guajava*) based agri-horti system. Online International Interdisciplinary Research Journal. 2014; 4(3):122-130.
10. Ramakrishna A, Tam HM, Wani SP, Long TD. Effect of mulch on soil temperature, moisture, weed infestation and yield of groundnut in northern Vietnam. Field Crops Research. 2006; 95:115-125.
11. Rana KS, Shivran RK, Kumar A. Effect of moisture-conservation practices on productivity and water use in maize (*Zea mays* L.)-based intercropping systems under rainfed conditions. Indian Journal of Agronomy. 2006; 51(1):24-26.
12. Roopashree DH, Nagaraju Ramesha YM, Bhagyalakshmi T, Raghavendra S. Effect of integrated nutrient management on growth and yield of baby corn (*Zea mays* L.). International Journal of Current Microbiology and Applied Science. 2019; 8(6):766-772.
13. Sharma UJ, Chakravarthy M, Bhattacharya HC. Emission and sequestration of carbon in soil with crop residue incorporation. Journal of the Indian Society of Soil Science. 2013; 61(2):117-121.
14. Singh RK, Singh A, Singh K. Effect of moisture conservation practices on linseed (*Linum usitatissimum* L.) under rainfed conditions. Environment and Ecology. 2014; 32(2):425-427.
15. Yuan C, Lei T, Mao L, Liu H, Wu Y. Soil surface evaporation processes under mulches of different sized gravel. Catena. 2009; 78:117-121.