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., M1:control (no mulch), M2:dust mulch and M3:rice straw mulch and integrated nutrient management include S1:100% RDF, S2:75% RDF + 25% N through poultry manure, S3: 100% RDF + 25% N through FYM and S4:100% 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, P₂O₅ and K₂O 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 S5:100% RDF and it were at par with S5: 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) [2]. Apart from this, the productivity of maize is also limited due to moisture stress (Rana et al., 2006) [3] 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) [4]. 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) [5] and increases the availability of soil water to the crops resulted regulation of soil temperature (Ramakrishna et al., 2006) [6]. 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 digestion method) with slightly alkaline to slightly acid conditions (pH 8.1). The available N (alkaline permanganate digestion method) with slightly alkaline in reaction (pH 8.1). The available N (alkaline permanganate digestion method) with slightly alkaline in reaction (pH 8.1). The available N (alkaline permanganate digestion method) with slightly alkaline in reaction (pH 8.1). The available N (alkaline permanganate digestion method) with slightly alkaline in reaction (pH 8.1). The available N (alkaline permanganate digestion method) with slightly alkaline in reaction (pH 8.1).

### Table 1: Chemical status of organic manures

| Organic manures | Nitrogen content | Phosphorus content | Potassium content |
|-----------------|------------------|--------------------|-------------------|
| FYM             | 0.48±0.0083      | 0.75±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 leaves, plant height, leaf area index and chlorophyll content during both the years of experimentation (Table 2, Fig. 2 and 3). Maximum mean number of leaves, 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 leaves, plant height, leaf area index and chlorophyll content. Application of 100% RDF + 25% N through poultry manure was recorded significantly number of

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

| 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) |
|-----------|----------------|-------------------|--------------------------|------------------------------------------|----------------------|----------------------|
| M₁: Control (No mulch) | 7.54 | 190.0 | 3.72 | 39.7 | 39.48 | 83.74 |
| M₂: Dust mulch | 9.53 | 216.0 | 4.27 | 45.2 | 50.80 | 90.01 |
| M₃: 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 |
| S₁: 100% RDF | 7.89 | 193.4 | 3.77 | 38.5 | 43.53 | 85.69 |
| S₂: 75% RDF + 25% N through Poultry manure | 8.62 | 201.8 | 4.10 | 42.3 | 45.63 | 87.08 |
| S₃: 100% RDF + 25% N through Poultry manure | 9.50 | 217.3 | 4.38 | 46.5 | 50.64 | 89.97 |
| S₄: 75% RDF + 25% N through FYM | 8.16 | 195.4 | 3.84 | 40.0 | 44.53 | 86.20 |
| S₅: 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
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.

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