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Response of nutrient management on growth and yield of rapeseed under rice fallow condition in Bishnupur district of Manipur

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Abstract

A Field experiment was conducted at Agricultural Research Farm of Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Bishnupur District, Manipur, India during *rabi* season 2018-2019 to study the effect of DAP application to preceding rice and foliar nutrition to rapeseed on the productivity and profitability of rapeseed (M-27) under rice fallow condition. The results indicated that application of 100 kg DAP ha⁻¹ at 15 days before harvest of preceding rice + 1% Urea + 1% KCl foliar spray twice at flowering initiation and 15 days after flowering to rapeseed registered higher growth as well as yield attributes (siliquae plant⁻¹, siliqua length (cm), seeds siliqua⁻¹) with resultant increased in seed (675.35 kg ha⁻¹) and stover (2205.59 kg ha⁻¹) yields.

Keywords: Growth, yield, rapeseed, foliar, siliquae

Introduction

Rapeseed-mustard is usually cultivated by farmers of Manipur under zero tillage condition after harvest of rice and also as relay crop in the standing rice crop. It has always the risk of its sowing, crop growth and establishment due to late recession of moisture in the rice field and the long duration of rice varieties cultivated in the farmers field (Singh *et al.*, 2010) [11].

In north-east India, farmers grow rice during rainy season (June–September) and land remains fallow after rice harvest in the post-rainy season (November–May) due to lack of sufficient rainfall or irrigation facilities. But in lowland areas, sufficient carry-over residual soil moistures are available in rice fallow in the post-rainy season (November–March), which can be utilized for growing second crops in the region such as oilseeds and pulses. In most of the areas farmers grow second crops by broadcasting the seeds within the standing rice crop (first crop) in well-moistened soils without any tillage at 15–20 days prior to the harvest of rice. The system of growing crops without tillage is called relay cropping where farmers obtain much less yield (0.2–0.3 t ha⁻¹) from second crops. It might be due to unfavourable physical conditions of the soil coupled with poor nutrient enrichment of soil which inhibit crop growth and nutrient uptake in rice fallow. Productivity and profitability from second crops in rice fallow can be improved with suitable crop management technique even by utilizing residual soil moisture.

Since rapeseed is grown after harvesting long duration rice varieties and late recession of moisture from rice fields in Manipur, the sowing of rapeseed gets normally delayed and the growth and vigour of rapeseed is not good as timely sown crop. However, the crop suffers usually from soil moisture deficit during its vegetative stage when sown after the harvest of rice. This condition is due to the exposure of soil in the sun at least for a period of 5 – 7 days after the harvest of rice crops. Moreover growing the crop after the harvest of rice is usually delayed by about 10 -15 days against the normal sowing time which usually occurs in the middle of October to middle of November. As the sowing time is delayed the farmers without any nutrient management practices directly sow the rapeseed seed in the paddy field. Rapeseed being one of the most important *rabi* crops in Manipur needs proper nutrient availability for its higher growth and development in time. So, proper nutrient enhancement technique is very much required to improve its nutrient uptake. With the improvement of nutrient supply the yielding potential can be maximized in great extent.

Materials and methods

The field experiment was conducted during the year 2018-2019 at Utlou mamang leikai near Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Bishnupur District, Manipur, India (Latitude: 24°43'54" N and Longitude: 93°51'31" S) with an altitude of 790 m above mean sea level. The experiment was laid out in Randomized Block Design (RBD) comprising five treatments. The treatments comprises of T₁ (100 kg DAP ha⁻¹ at flowering + 1% KCl foliar spray twice at flowering initiation and 15 days after flowering), T₂ (2% DAP + 1% KCl foliar spray twice at flowering and 15 days after flowering), T₃ (100 kg DAP ha⁻¹ at 15 days before harvest of preceding rice + 2% DAP + 1% KCl foliar spray twice at flowering initiation and 15 days after flowering), T₄ (100 kg DAP ha⁻¹ at 15 days before harvest of preceding rice + 1% Urea + 1% KCl foliar spray twice at flowering initiation and 15 days after flowering) and T₅ (Control).

The initial soil status of the experimental field was clay in texture with slightly acidic soil reaction (pH 5.7), high in organic carbon (1.28%), medium in available N (319.86 kg ha⁻¹), medium in available P₂O₅ (45.58 kg ha⁻¹) and medium in available K₂O (295.68 kg ha⁻¹) which was found out with the help of standard methods *viz.*, for pH by Glass electrode pH meter (Jackson 1973) [5], organic carbon (OC) was determined following Walkley and Black (1934) [14], available nitrogen (N) following Subbiah and Asija (1956) [13], available phosphorous (P) by following Bray and Kurtz (1945) [2] and available potassium (K) by flame photometer as described by Jackson (1973) [5].

Plant height of five randomly tagged plants was measured from base of plant up to the growing tips of main stem and average height was recorded in cm. The observation were made at 25, 50, 60 DAS and at harvest. The primary and secondary branches were counted at 50, 75 DAS of crop growth and at harvest. Total number of siliquae on five tagged plant were counted and average number of siliquae per plant was recorded. Length of siliqua of five plants was measured with a linear scale and expressed as mean length of siliqua (cm). Ten siliquae were split open and number of seed was counted and the mean was expressed. The seed and stover yield of net plot after cleaning and proper drying was recorded in grams and converted into kilogram per hectare by multiplying with appropriate conversion factor.

The observations recorded during the course of investigation were tabulated and analyzed statistically to draw a valid conclusion. The data were analyzed as per the standard procedure for "Analysis of Variance" (ANOVA) as described by Gomez and Gomez (1984) [4].

Results

Growth characters

The results revealed that nutrient management practices had significant influences on various growth characters of rice fallow rapeseed (Table 1). The combined application of 100 kg DAP ha⁻¹ at 15 days before harvest of preceding rice + 1% Urea + 1% KCl foliar spray twice at flowering initiation and 15 days after flowering significantly improved the plant height, number of primary and secondary branches plant⁻¹ than no DAP application and foliar spray at all the growth stages. This might be due to the favourable enhancement in vegetative growth and development as a result of DAP application to the preceding rice which acted as basal dressing to rapeseed and also foliar spray of urea and KCl as rapid nutrient supply to rapeseed in reduced soil nutrient

availability after rice. Duary and Ghosh (2013) [3], Sinha *et al.* (2018) [12] and Kaur *et al.* (2019) [6] also reported similar findings in increased plant height. It is also evident that the capacity of soil to provide sufficient nutrients also increased with increasing nutrients incorporation resulting in increased plant height and production of primary and secondary branches. Similar findings were reported by Bhat *et al.* (2006) [1] and Mohiuddin *et al.* (2011) [8].

Yield attributes and yield

Significantly higher number of siliquae plant⁻¹, siliqua length, seeds siliqua⁻¹, seed and stover yield was recorded (Table 1 and 2) in treatment T₄, receiving 100 kg DAP ha⁻¹ at 15 days before harvest of preceding rice + 1% Urea + 1% KCl foliar spray twice at flowering initiation and 15 days after flowering. Application of DAP to the preceding rice crop favoured better growth characters of rapeseed followed by foliar spray of DAP and KCl during flowering stage improved the photosynthetic efficiency, reduced flower dropping and increased seed setting which in turn favoured higher yield parameters of rapeseed.

No nutrients application registered significantly lesser number of pods than other treatments. Application of DAP either to preceding rice crop or foliar spray to rapeseed resulted in significantly higher grain yield over control *i.e.* without nutrients application. Application of 100 kg DAP ha⁻¹ at 15 days before harvest of preceding rice + 1% Urea + 1% KCl foliar spray twice at flowering initiation and 15 days after flowering registered significantly higher seed yield (675.35 kg/ha) over control. This might be due to application of DAP to preceding rice acted as basal dose to rapeseed which resulted in higher root and shoot growth. Foliar spray of nutrients during flowering stage increased photosynthetic efficiency which in turn enhanced higher yield attributes and seed yield of rapeseed. Similar findings were reported by Singh *et al.* (2000) [10], Yadav *et al.* (2005) [15], Sarma *et al.* (2015) [9] and Maheshwari and Karthik (2017) [7].

Table 1: Effect of nutrient management on plant height (cm) at different stages of crop growth of rapeseed

Treatment	Plant height (cm)			
	Days after sowing			At harvest
	25	50	75	
T ₁	12.45	32.36	38.25	41.75
T ₂	11.65	31.45	42.27	45.7
T ₃	17.26	39.51	48.48	53.1
T ₄	17.78	41.52	52.92	57.75
T ₅	11.53	30.325	35.40	37.5
SEm±	0.82	0.96	0.80	0.60
CD (P=0.05)	2.53	2.95	2.47	1.87

Table 2: Effect of nutrient management on number of primary and secondary branches plant⁻¹ at different stages of crop growth of rapeseed

Treatment	Primary branches (plant ⁻¹)			Secondary branches (plant ⁻¹)		
	Days after sowing		At harvest	Days after sowing		At harvest
	50	75		50	75	
T ₁	2.75	4	4	1.48	2.33	2.33
T ₂	2.90	4.18	4.18	1.55	2.40	2.40
T ₃	3.70	4.45	4.45	2.10	2.65	2.65
T ₄	3.85	4.85	4.85	2.23	3.05	3.10
T ₅	2.70	3.15	3.15	1.40	1.85	1.88
SEm±	0.13	0.12	0.12	0.12	0.08	0.07
CD (P=0.05)	0.39	0.39	0.39	0.36	0.25	0.21

Conclusion

Based on the results of one year field experiment, it can be concluded that combined application of 100 kg DAP ha⁻¹ at 15 days before harvest of preceding rice and foliar spray of 1% Urea + 1% KCl twice at flowering initiation and 15 days after flowering to rapeseed gave the highest values of growth, yield attributes and yield.

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