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Response of different rapeseed (*Brassica campestris*) and mustard (*Brassica juncea*) varieties on growth and yield under zero tillage conditions

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Abstract

A field experiment was conducted at Langthabal Makha Leikai, Imphal West, Manipur, India during the *rabi* season of 2018-2019 to study the response of different rapeseed and mustard varieties on growth and yield under zero tillage conditions. The results indicated that the adoption of zero tillage had significant response on growth, yield and yield attributes on different rapeseed and mustard varieties. The variety NRCHB-101 gave the maximum seed yield (930.20 kg/ha) and stover yield (1804.45 kg/ha) while for harvest index, the variety TS-38 was found highest (34.41%). The variety NRCHB-101 recorded the maximum net return (₹23,237/ha) and benefit cost ratio (1.99) among the rapeseed and mustard varieties. From this research output, it can be concluded the variety NRCHB-101 may be used on commercial scale by the farmers in terms of productivity and profitability making mustard cultivation viable.

Keywords: Rapeseed, mustard, zero tillage, growth, yield, economics

Introduction

Mustard-rapeseed group of crops are among the oldest cultivated plants in human civilisation. It is a group of oilseed crops which assumes the significance in Indian national economy by occupying the second position next to groundnut and is considered as a cash crop. The traditional mustard-rapeseed grown in India contains high amount of erucic acid and glucosinolates and this does not conform the international standard 'canola quality'. It is grown in more than 53 countries in Asia, Europe, America and Australia. India and China together accounted for 42% of total production.

India is the fourth largest oilseed economy in the world. Among the seven edible oilseed cultivated in India, rapeseed-mustard contributes 28.6% in the total oilseed production and ranked 2nd after groundnut sharing 27.8% in the India's oilseed economy (Rathore *et al.*, 1998) [7]. Manipur occupies 7.62 lakh hectare areas with 7.53 lakh tonnes production of rapeseed and mustard (2013-14). The average productivity of rapeseed and mustard in Manipur is 989 kg/ha.

Selection of variety is important for producer to achieve high crop yield by improving the fertilizer use efficiency and water use efficiency. The old and degenerated cultivars due to their low yield potential and other drawbacks like maturity, shattering habit, poor response to fertilizers and irrigation and susceptibility to insect-pest and diseases have poor productivity as compared to improved cultivars of the region. It is also a fact that specified genotypes does not exhibit the same phenotypic characteristics in all environmental conditions. Thus, improved cultivar is an important tool, which has generated production of mustard in many countries of the world. In North Eastern Hill region, the cultivation of oilseeds faces several constrains. It includes water scarcity during post monsoon season, lack of irrigation facilities, short time lag after rice harvest for seed sowing and high incidence of pests and diseases in late sown crop. Cultivation of *rabi* crops to mostly late sowing leads to crop failures.

Zero tillage cultivation system of rapeseed mustard which initially originated from Manipur led to a success in expansion of area in the state. Zero tillage technology is very conducive in increasing the rapeseed production and net income. Its popularity is increasing day by day among the farming community in Manipur state. The natural resources are precious and therefore demand an effective and sustainable use.

Zero tillage is a potential technology in the scenario. Stresses under zero tillage are unique like heavy soil type, lack of irrigation, difficulty in fertilisation due to un-open soil, residual paddy straws etc. Thus, selection of the suitable varieties for the crop under zero tillage cultivation has become an indispensable step for expanding the crop area and to raise the production.

Materials and Methods

The field experiment was conducted during the *rabi* season of 2018-2019 at a rice cultivated field of Langthabal Makha Leikai, Imphal West, Manipur, India situated at about 24.76°N latitude and 93.92°E longitude with an altitude of 775m above mean sea level. The experiment was laid out in Randomized Block Design (RBD) with four replications and six treatments. The treatment comprises of T₁ (M-27), T₂ (TS-36), T₃ (TS-38), T₄ (TS-67), T₅ (Local Yella) and T₆ (NRCHB-101). The initial soil status of the experimental field was silt loam with acidic soil reaction (pH 5.89), medium in organic carbon (1.0%), medium in available N (340.16 kg/ha), low in available P₂O₅ (39.28 kg/ha) and medium in available K₂O (290.68 kg/ha). Biometric parameters namely plant height was recorded periodically at 20, 40, 60, 80 days after sowing (DAS) and at the time of harvest, number of leaves per plant was recorded periodically at 20, 60 and 90 DAS and number of branches per plant was recorded at the time of harvest. Yield and yield attributing characters namely number of siliqua per plant, length of siliquae, seeds per siliqua, test weight, seed yield, stover yield were recorded at time of harvest. The economics of the different rapeseed-mustard variety was also worked out. The data recorded for various characters were statistically analysed by adopting the procedure of analysis of variance as per Gomez and Gomez (1984). Significance of the difference in the treatment effects were tested through "F" test and critical difference C.D. was calculated wherever the results were found significant.

Results and discussion

Growth attributes

The results revealed that the growth attributes of different rapeseed and mustard varieties were significantly influenced (Table 1, Table 2 and Table 3). The highest growth attributes *i.e.* plant height, number of leaves per plant and number of primary and secondary branches was recorded under T₆ (NRCHB-101). Significant enhancement in plant height, number of leaves and number of primary and secondary branches under zero tillage seems to be due to the improvement in growth by virtue of adequate supply of moisture and metabolites. These findings are in consistency to those obtained by Saha *et al.* (2010)^[4] and Aiken *et al.* (2015)^[2].

Yield and yield attributes

Significantly higher number of siliqua per plant (148.48) and seeds per siliqua (14.15) was recorded from the treatment T₆ (NRCHB-101) (Table 4). This might be due to the favourable effect of zero tillage on growth and yield attributing characters which enhanced the moisture availability to plants and lead to more foliage development, greater photosynthetic activity and consequently higher growth and development. The increased number of siliqua and seeds per siliqua could be due to the better translocation of nutrients and assimilates to the reproductive regions. These findings are in good lines with those achieved by Mondal *et al.* (2008)^[6], Ghosh *et al.* (2010)^[4], Singh *et al.* (2014)^[10] and Aiken *et al.* (2015)^[2]. The siliqua length and test weight were found non-significant.

The seed, stover and harvest index of rapeseed and mustard was significantly influenced under zero tillage conditions. Highest yield *i.e.* seed yield (930.20 kg/ha) and stover yield (1804.45 kg/ha) was recorded for the treatment T₆ (NRCHB-101) (Table 5).

This might be attributed to the fact that, zero tillage has more moisture and nutrient availability, higher plant population and higher dry biomass of plants which led to increase in yield attributes by virtue of adequate supply of metabolites from the leaves due to increased growth. Similar findings were also reported by Rathore *et al.* (1998)^[8], Habibollah *et al.* (2014)^[5] and Alizadeh *et al.* (2015)^[3].

Table 1: Response of different rapeseed and mustard varieties on plant height (cm) at different stages of growth

Varieties	Plant height (cm)				
	20DAS	40DAS	60DAS	80DAS	At harvest
M-27	4.68	16.11	62.86	75.11	75.87
TS-36	4.46	16.14	61.26	73.23	74.02
TS-38	4.24	16.64	61.23	73.11	76.89
TS-67	4.43	16.18	62.83	72.73	74.15
Local Yella	6.53	28.16	81.78	99.82	116.16
NRCHB-101	6.72	36.61	96.96	109.34	137.85
SE(m)±	0.94	0.57	0.71	0.75	5.31
CD (5%)	NS	1.72	2.13	2.27	16.01

Table 2: Response of different rapeseed and mustard varieties on number of leaves per plant

Varieties	Number of leaves per plant		
	30DAS	60DAS	90DAS
M-27	4.41	13.69	0.85
TS-36	3.96	12.20	0.87
TS-38	4.11	12.82	0.75
TS-67	4.15	12.73	0.80
Local Yella	5.08	17.14	24.60
NRCHB-101	6.76	26.17	33.59
SE(m)±	0.97	0.98	0.75
CD (5%)	NS	2.95	2.28

Table 3: Response of different rapeseed and mustard varieties on number of primary and secondary branches per plant at the time of harvest

Varieties	Primary branches	Secondary branches
M-27	4.67	7.37
TS-36	4.50	7.25
TS-38	4.78	7.72
TS-67	4.39	7.09
Local Yella	5.15	8.28
NRCHB-101	8.43	13.99
SE(m)±	0.37	0.64
CD (5%)	1.12	1.93

Table 4: Response of different rapeseed and mustard varieties under zero tillage conditions on siliqua length (cm), siliqua per plant, seeds per siliqua and test weight (g)

Varieties	Siliqua length (cm)	Siliqua per plant	Seeds per siliqua	Test weight (g)
M-27	4.21	75.67	13.90	3.70
TS-36	4.11	78.09	13.95	3.61
TS-38	4.03	74.76	13.95	3.32
TS-67	4.19	79.70	13.92	3.41
Local Yella	4.09	116.30	13.47	2.57
NRCHB-101	4.24	148.48	14.15	3.82
SE(m)±	0.28	0.93	0.49	0.98
CD (5%)	NS	2.80	1.47	NS

Table 5: Response of different rapeseed and mustard varieties on seed yield, stover yield and harvest index

Varieties	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
M-27	799.29	1558.29	33.91
TS-36	801.00	1593.55	33.46
TS-38	784.43	1495.84	34.41
TS-67	809.09	1650.21	32.91
Local Yella	614.72	1319.56	31.80
NRCHB-101	930.20	1804.45	34.01
SE(m)±	5.36	25.22	0.45
CD (5%)	16.16	76.03	1.35

Economics

The rapeseed and mustard varieties were found to be significantly influenced on net returns and cost benefit ratio by zero tillage cultivation. The treatment T₆ (NRCHB-101) (Table 6) recorded the highest net return (₹23,237/ha) and cost benefit ratio (1.99). The increase in net return was due to the increase in yield attributing character and grain yield of rapeseed and mustard varieties. This collaborates the finding of Aheibam *et al.* (2014)^[1].

Table 6: Response of different rapeseed and mustard varieties under zero tillage conditions on economics

Varieties	Gross return (₹/ha)	Net return (₹/ha)	B:C ratio
M-27	39964	16691	1.71
TS-36	40050	16776	1.72
TS-38	39221	15948	1.68
TS-67	40454	17181	1.73
Local Yella	30736	7462	1.32
NRCHB-101	46510	23237	1.99
SE(m)±	268.15	268.15	0.01
CD (5%)	808.30	808.30	0.04

Conclusion

Based on the results from the experiment it can be concluded that the variety NRCHB-101 gave the maximum values in terms of growth, yield and economic return among other rapeseed and mustard varieties.

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