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Effect of Sowing Dates and Planting Geometry on Growth and Yield of Different Parameters of Indian Mustard Var. RGN-73 in Tarai Region

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Abstract

A field experiment was conducted during *rabi* season of the year 2014 and 2015 at Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, (Uttarakhand) to assess the effect of sowing times (22nd October, 1st November and 11th November) and plating geometries on the thermal requirement of Indian mustard var. RGN-73. The crop sown on 22nd October was found superior for accumulation of all the thermal indices; and among the planting geometries, the wider geometries (30 × 30 cm, 45 × 15 cm and 45 × 30 cm) accumulated more thermal units. Seed yield was found highest in case of the 22nd October sown crop (1665.3 kg/ha) followed by 1st and 11th of November while the closer geometries 30 × 10 cm (1635.2 kg/ha) and 30 × 20 cm (1650.3 kg/ha) reported more grain and seed yields. The HUE was in accordance with the seed and biological yields; therefore it could be used as a measure to decide the most favorable time of sowing to get higher yields of Indian mustard. The October 22 sown crop exhibit better vegetative growth and final yield than that of others. Closer plant sapcing resulted into more vertical growth. Closer geometries exhibited maximum yield than on the spacing. Using closer geometries with a delay in sowing would result into better yields.

Keywords: *Brassica Juncea*; Sowing Dates; Planting Geometries; Vegetative Growth; Seed Yield.

Introduction

Crop yield is influenced by several factors out of these, weather is the only environmental factor which influences the growth of the crop cycle. Sowing time affects various varieties in clear ways. Delay in sowing causes drastic reduction in yield than timely sowing.

Rapeseed- mustard being a cool season crop, is mainly influenced by temperature. In India, mustard is mostly grown in northern and north-western parts of the country as a *rabi* (winter season) crop after harvest of *kharif* (wet rainy season) crop. The crop requires high temperature during vegetative growth stage; and cool weather, clear sky during reproductive phase for better development the tools and techniques are needed to assist in developing strategies that can lead to higher food production, prevent crop production losses, and ensure minimal greenhouse gas emissions.

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Methodology

The investigation was conducted in silty clay loam soil at Norman E. Borlaug Crop Research Centre (CRC) of the Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (29°N latitude and 79.3°E longitude with an elevation of 243.83 m from the mean sea leve), during the *rabi* season of the year 2014-15 l. This region comes under sub-humid and sub-tropical climate with four distinct seasons Having average rainfall of this area is about 1434.4 mm annually with maximum precipitation during the South-West monsoon. The daily meteorological data used for the study (*i.e.* minimum and maximum temperature, bright sunshine hours) were taken from Agrometeorological observatory at Norman E. Borlaug Crop Research Centre of the University.The experiment was laid out in Split Plot Design taking the plots of 4.2 m × 3.6 m with three replications having three planting dates *viz.* 22nd October, 01st November and 11th November, as main plot treatment and five planting geometries *viz.* 30 × 10 cm, 30 × 20 cm, 30 × 30 cm, 45 × 15 cm and 45 × 30 cm as sub-plot treatment. Indian mustard (*Brassica juncea*) variety RGN-73 was selected for the experiment which is a medium maturing variety and takes 120-151 days to mature (Yadava and Shekhawat, 2007).

Recommended dose of fertilizers for the mustard crop *i.e.* 120 kg N, 40 kg P_2O_5 and 20 kg K_2O per ha were applied through Urea, Single Super Phosphate and Murate of Potash. Phosphorus and potassium were applied at the time of sowing while the nitrogen was applied in three split doses of 40 kg/ha each at sowing, 30 and 60 DAS for all the treatments. The number of days taken to attain various phenophases of mustard was determined visually by daily field inspection.

The height of selected plants was measured in cm with the help of meter scale from the base of plant to the tip of the plant at every 30 days interval from sowing to the maturity.Leaf Area Index (LAI) is a dimensionless quantity that characterizes plant canopies. It is defined as the ratio between leaf area to the ground area. LAI of all the plots was measured at every 30 days interval from sowing to the maturity using by the given formula:

$$\mathrm{LAI} = \frac{\text{Total leaf area (m}^2\text{)}}{\text{Total ground area (m}^2\text{)}}$$

One plant from each plot were selected at random and uprooted at every 30 days interval, placed inside an electrical oven at 65-75°C for three days. After complete drying of the plant sample, oven dry weight of the sample was taken and recorded in g/plant.After threshing and winnowing of seeds obtained from the net plot area of individual plot were weighed and recorded as seed yield in kg/plot and was converted into kg/ha to get the final yield on hectare basis. Weight of thoroughly sun dried harvested produce of each plot was recorded separately before threshing and expressed as biological yield in kg/plot and was converted into kg/ha.

Results and Discussion

The weather conditions in the experiment years is shown in Figure 1 & 2. Plant height as influenced by different dates of sowing and planting geometry has been shown in Fig 3. In general, plant height increased with advancement of crop age up to its maximum at maturity. The effect of sowing dates was pronounced on plant height at all of the stages . the influence of geometry was also clearly visible for all the crop stages except at 30 days stage. at all the time intervals, Plant height, was found more for the October 22 sown crop as compared to that, of November 01 and November 11 sown crop. similar results has also been reported by *Goyal et al. (2006) and Bhuiyan et al. (2008).* Plants with 30 × 20 cm were observed taller than that of the other geometries at all the growth stages of crop except at 30 days. At 120 days 30 × 20 cm geometry reported the maximum plant height followed by 30 × 10 cm, 30 × 30 cm and so on.

Effect of sowing dates and planting geometries on LAI at various growth stages of Indian musterd has been presented in Figure 4. The leaf area index attained its maximum value for all the sowing dates at 90 days and decreased thereafter for all the sowing dates. The value of LAI was all the time high for October 22 followed by November 01 and November 11. *Tripathi (2003) and Pande (2009)* have also reported the similar results.Delay in sowing caused considerable decrease in LAI at these stages. The 30 × 20 cm geometry resulted in the maximum value of LAI as compared to the other geometries, its values were at par with that of 30 × 20 cm and 30 × 30 cm, and significantly higher over 45 × 15 cm and 45 × 30 cm at 60 days.

Dry matter accumulation, in general increased gradually with advancement of crop age which is reported in Figure 5. Its peak value was attained at 120 days. Sowing dates had direct bearing upon dry matter accumulation at all the stages from germination to maturity, however, the effect of geometry was not visible at 30 days. The crop sown on October 22 accumulated more dry matter at all the stages as compared to the two later grown crops. November 11 sown crop accumulated least dry matter among all the three dates of sowing. A good amount of dry matter accumulated in timely sown crop thanthat of late sown one. Similar results have been reported by *Dehghani et al. (2008).*

The 30 × 20 cm geometry accumulated the highest dry matter at 120 days which was significantly superior over that of all the other geometries. 45 × 30 cm accumulateed the least amount of dry matter at all the stages of growth.The seed yield of Indian mustard as influenced by different dates of sowing and planting geometry has been reported in Fig. 6. The seed yield decreased with delay in sowing date from 22nd of October to the 11th of November, showing the highest yield 1665.3 kg/ha for 22nd October and the lowest yield 1265.8 kg/ha for 11th of November. a decrease in seed yield of Indian mustard with delayed sowing have also been reported by Afroz *et al.* (2011). Among the various planting geometries 30 × 20 cm produced the highest seed yield being higher thanthat of the two geometries of 45 × 15 cm and 45 × 30 cm. the geometries of 30 × 10 cm and 30 × 30 cm, however did not differ significantly. Similar findings on planting geometry have been reported by Hassan and Arif (2012). The effect of sowing dates was found clear on the biological yield.Biological yield reduced as the sowing date got delayed from 22nd of October to the 11th of November. The crop sown on 22nd of October produced the highest biological yield being higher than that of 1st and 11th of November. It was found that 30 × 20 cm produced the highest biological yield followed by 30 × 30 cm and 30 × 20 cm planting geometries.

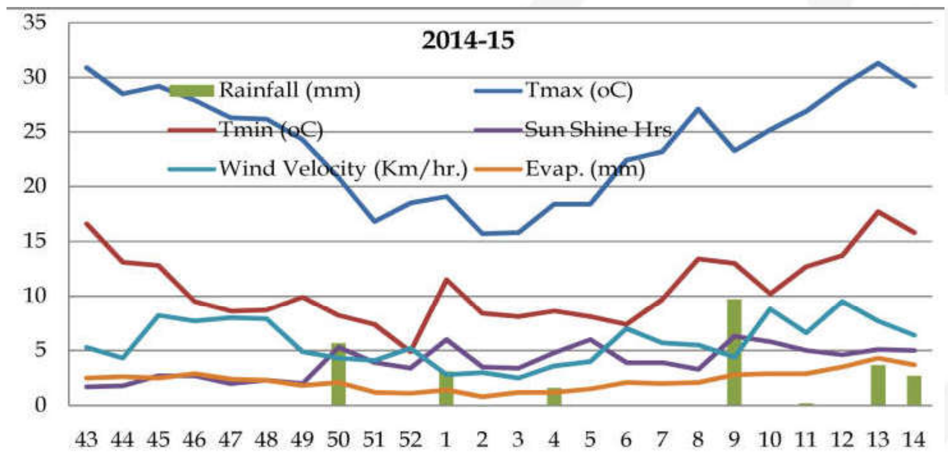

Fig. 1: Variation in different weather variables during crop growing season 2014

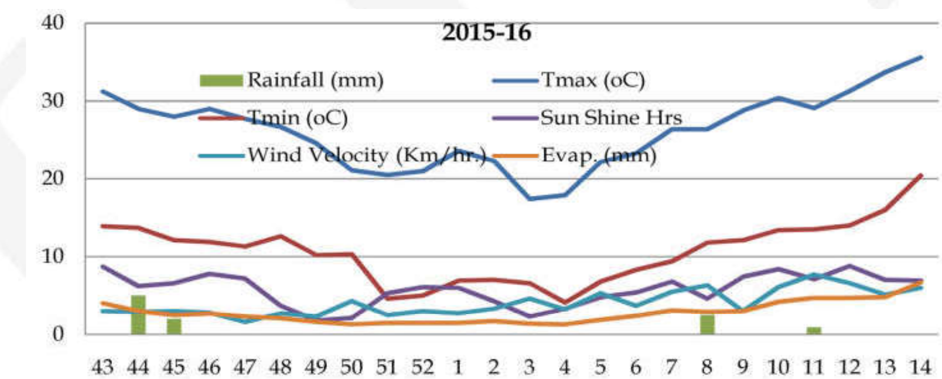

Fig. 2: Variation in different weather variables during crop growing season 2015

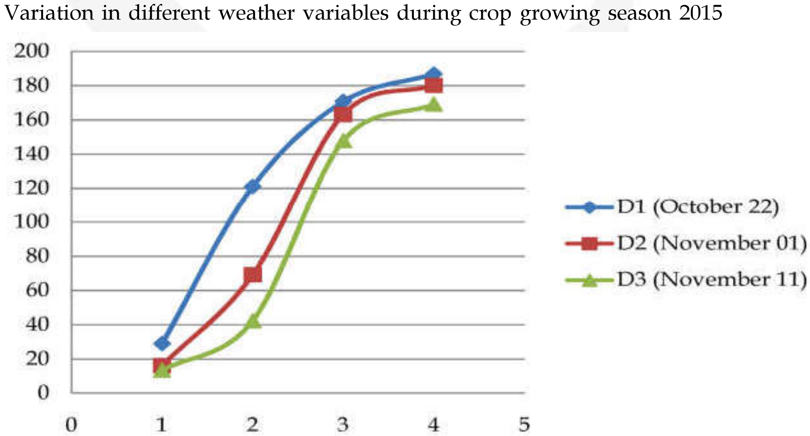

Fig. 3a: Temporal variation of plant height (cm) (pooled)

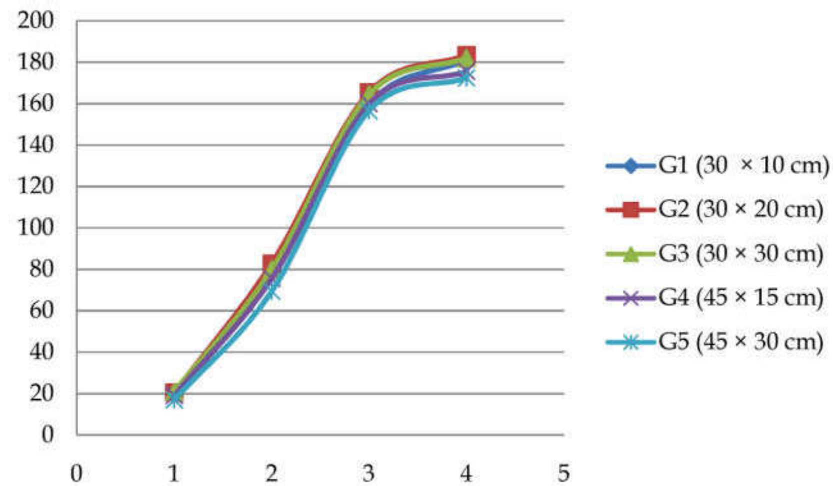

Fig. 3b: Temporal variation of plant height (cm) (pooled)

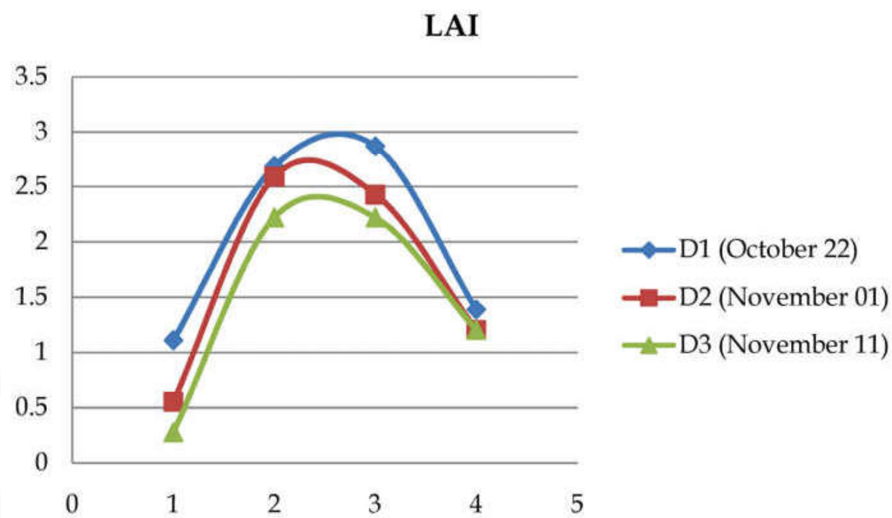

Fig. 4a: Temporal variation of LAI (pooled)

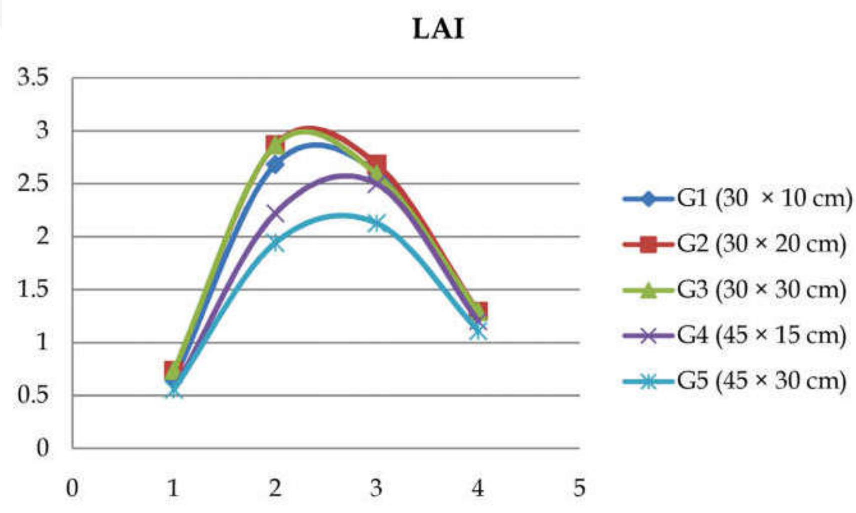

Fig. 4b: Temporal variation of LAI (pooled)

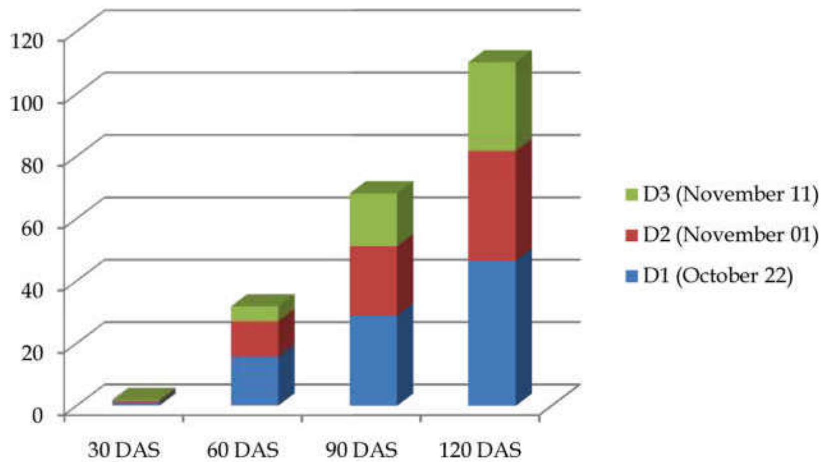

Fig. 5a: Temporal variation of dry matter accumulation (g/plant) (pooled)

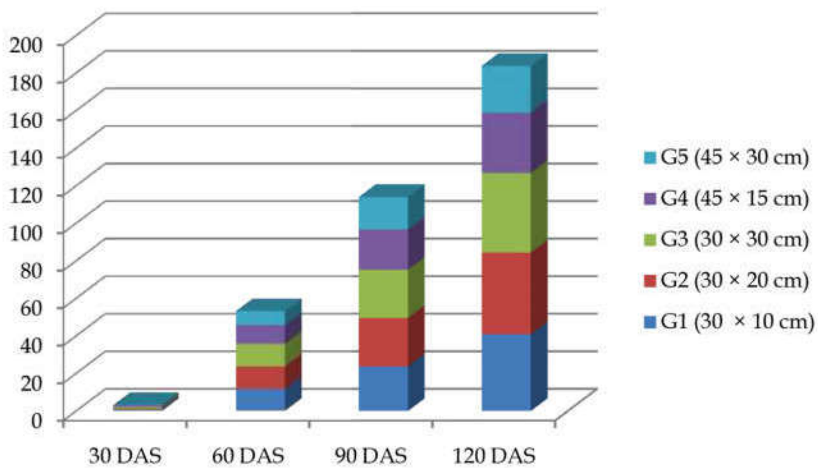

Fig. 5b: Temporal variation of dry matter accumulation (g/plant) (pooled)

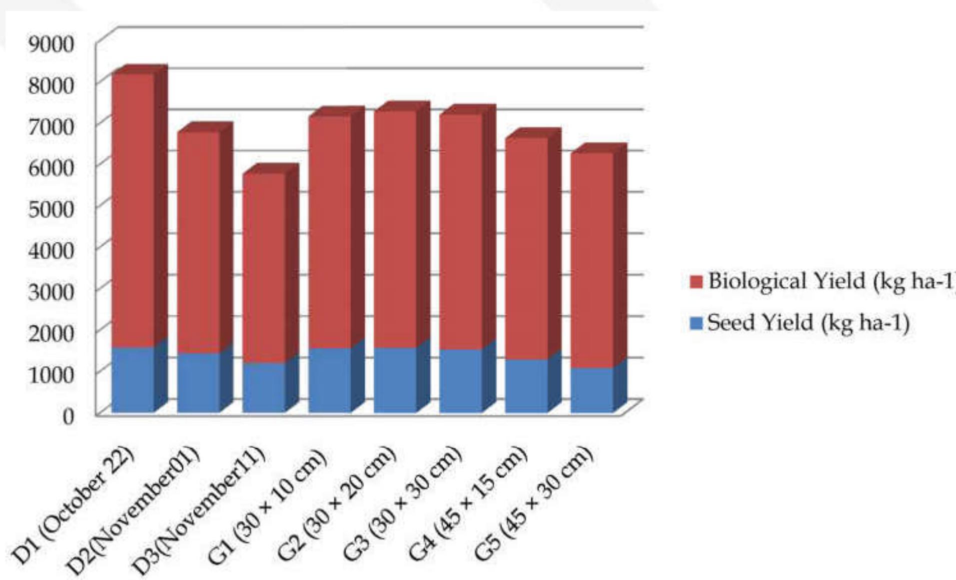

Fig. 6: Yield components of Indian mustard as influenced by dates of sowing and planting geometry (pooled)

Conclusion

The October 22 sown crop produced taller plants than that of others. Closer plant sapcing resulted into more vertical growth than wider spaced.Date of sowing and planting geometry had direct bearing upon on leaf area index. The peak LAI was recorded with sowing on 22nd October and plants with closer geometries.It increased with advancement of crop age, and attained its maximum at 120 daysand was maximum for the first date of sowing and a closer spacing.The crop sown on 22nd of October resulted into a higher seed yield over the late sowing. Though the magnitude of all the yield attributes was more for wider geometries but their cumulative effect on per hectare basis was lower than that of the closer geometries resulting in a lower grain yield.biological yield reported its maximum for the closer spacing and 22 October sowing, too. Therefore, it may inferred that using closer geometries with a delay in sowing would result into higher seed yields.

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