Airo International Research Journal
Volume XIII, ISSN: 2320-3714
October, 2017
Impact Factor 0.75 to 3.19

UGC Approval Number 63012

A STUDY OF YIELD AND QUALITY OF RAPESEED-MUSTARD VARIETIES

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ABSTRACT:

Oilseed and oil has assumed an importance of their own in the economy of the country as well as in the life of people for balanced nutrition. Among the different oilseed crops, rapeseed and mustard holds a key place in Indian agriculture. In West Bengal, it is the most important oilseed crop occupying an area of 4.1 lakh hectares with a production of 4.20 lakh tonnes. The predominant rapeseed and mustard varieties of West Bengal are B-9 and B-85 respectively with an average yield of 1021 kg ha-1 (Anonymous, 2012). These varieties are very old and needed to be replaced by the new high yielding varieties. In Gangetic plains of West Bengal where winter is short and cropping intensity is high, the choice of rapeseed and mustard variety is very critical. In this case cultivation of improved short duration high yielding varieties of rapeseed and mustard can be the solution to increase the production and make the rapeseed and mustard cultivation more profitable.

KEY WORDS: Rapeseed and Mustard, Variety, Date of sowing, Aphid infestation, Yield.

INTRODUCTION:

Aphid is a major pest in rapeseed-mustard cultivation. It has been found from different research that adjustment in date of showing of rapeseed-mustard in a greater extent to escape the infestation of this obnoxious pest. Not only this, Alter aria blight and white rust are another disease which may to some extent be controlled through cultural manipulation and also host resistant differ with different variety.

Keeping in view, an experiments "Effect of *date* of showing on growth, yield and quality of rapeseed-mustard varieties", has been under taken. Here date of showing their integration with different rapeseed-mustard varieties regarding growth, yield and quality was elaborately be studied.

The oilseed production in the state of West Bengal has registered almost a threefold increase during the past decade. The major share of such phenomenal growth may be attributed to rapeseed-mustard.

It is true that, although there has been progressive increase in area, production and productivity in rapeseed-mustard during the last decade, there is not much scope left to increase production through extension of acreage with out affecting acreage of other crops. By productivity figure as indicate bellow of the major rapeseed-mustard growing district of the state will indicate that the production potential of the crop under the growing condition of West Bengal.

So, there is acute need of some basic scientific information as to the reaction of short and long duration varieties in the short and mild winter condition of West Bengal for the breeding and management of new varieties.

Production potentiality of a genotype can be fully exploited by adopting suitable agronomic practices. Among the different agronomic practices, optimum sowing time plays a great role to fully exploit the genetic potentiality of a variety as it synchronises the optimum environmental conditions such as temperature, light, humidity, rainfall etc. with the different growth phases of the crop and results in better expression of the crop in terms of growth and yield. It is a fact that specified genotypes does not exhibit the same phenotypic characteristics in all environmental conditions. The different genotypes, growth responses varies to different environment and eventually decides the selection of a genotypes for a particular or different date of sowing for stabilizing higher yields. The aphid (Lipaphyserisimi) is an important insect pest of mustard and causes heavy yield losses worldwide. They suck the sap from the plant and hamper the plant nutrition to a great extent. As a result, plant loses their vigour and their growth is hampered

which ultimately affects the yield of the crop. The yield losses may be 10-90% depending upon the severity of damage and the stage of the crop.

From the above points it is clear that varieties, date of sowing and aphid plays a great role in the production of the rapeseed and mustard. However, very few works has been done on rapeseed and mustard crop integrating all these components in Gangetic plains of West Bengal. Hence the present studies was carried out to find out new high yielding varieties of rapeseed and mustard andtheir suitable sowing time to augment the production of this highly important oilseed crop in this region and also to find out the relative susceptibility of these high yielding cultivars to the aphid infestation.

LITERATURE REVIEW:

Thakur et al (2018). Indian mustard was best when sown in the 1st week of October for increasing productivity. (Varuna) showed least performance when sown at 2nd fortnight of October, and showed yield reduction with delayed sowing.

Late sown crops were, however, badly infested with aphid. Sowing in the first week of October is suggested to be effective to overcome the damage on the crop by aphid (singh et al, 2017), they also reported that mustard varieties showed higher tolerance against the aphid infestation as compared to rapeseed varieties. The crop sown 10 to 15 days advance to the normal sown crops escaped aphid infestation without any reduction in yield, where as 10 to 30 days late sown crops were heavily infested and suffered considerable yield losses. At kalyani, West Bengal late sowing reduced the yield due to attack of aphid or Alternaria blight (Annual Report of all India Rabi oilseed workshops, New Delhi, 2011-12).

Reddy et al (2016) found that optimum date of sowing of repeseed-mustard resulted in high growth, yield. And yield components compared with delay sowing of crops. Significant interaction between the date of sowing and cultivars showed that produced greater seed yield.

Gangasaran and Dey 2017 revealed that the under rainfed condition of Delhi in ideal time was found to be mild October. Delayed sowing of toria cultivars was a drastic reduction of seed yield.

Tyagi et al (2017) reported that, early sowing resulted in early flowering, longer seed filling period a longer reproductive phase and ultimately a higher seed yield per hectare. A positive correlation was obtained between dates of sowing and various phonological phases and also seed yield.

Mondal et al (2017) reported that, Aphid population varied from at different sowing dates the lowest aphid infestations were observed in crops sown on 15th October. The yield losses in delay sowing date were found 31.9% to 33.3%.

Zekait (2017), observed that when rapeseed and mustard was sown in early October, the earliest sown crop produced the tallest plants, highest siliquae, highest seeds per siliquae, greatest 1000- seed weight and seed yield as compound to late some crop.

A field triad were conducted by zekaite (2017) in 2015-16 at the perloja Research station, Ludhiana and observed that with mustard was sown in early in October in better result than late sowing. The earliest sown crop produced the tallest plants, most pods (63.3-66.0/plant), most seed per pod (4.5), and greatest 1000-seed weight.

Singh et al (2018), conducted at an experiment kangra during the winter seasons to study the response of 4 Brassica species to different sowing date under the mid hill codifies of Himaehal Pradesh, India. B. napus cv. HpN-1, B comestris cv BSH-1 and B. caninata cv. HPC-1 wer sown in the first week of October for increased productively, where asB.jurcea cv. Varuna was best sown in 2nd for triught of October. B.jumcea showed less yield reduction with delayed sowing followed by B.carinatn of the species tested.

Yadav et al (2017) reported that pusa bold variety gave mean seed yield 2.10, 2.00 and 1.75 t/ha when sown an 17)ctober, 27 October and 6 November respectively. Yield was 1.84 t/ha with irrigated condition and produced hightsiliquae/plant and 1000-seed weight also.

Tomar (2017) observed that, six sowing date (20 and 30 October, 10,20 and 30 Novermer, and 10 December) and six gave types (TKG-5,TKG-35, TKG-69, TKG-72, TKG-73 and pusa bold) of B. juncea were compared for two consecutive searous at tikamgash. Seed yield

progressively decreased as sowing date was delayed beyond 30 October, and was highest in cv. TKG-73 and TKG-5.

Chandra et al (2017), in trials at Cuttack during 2000-04 with Brassica compesitris cv.M-27, toria, t-9 and ToriaBhawari and B.junceac.vpusa Bold, PusaBahar, PusaBasant and varanaobserved average seed yields of 0.9 and 1.8 t/he respectively newly introduced B. juneca hybrids showed potential with an yield of 1.5 t/ha and mustard 15 days earlier then varuna. Sowing pusaBold on 15 November gave higher yield than sowing an 25 October or 30 November. An experiment with three sowing dates and eight B.juncea cultivars was conducted in the Nor then Telaugana region of Andra Pradesh during the winder seasons of 2014-15 and 2015-16 and it was observed that the yield was 646 ks/la when soon on 4 October and decreased by 6.2 and 24.8% when sown 19 October and 5 November. Cultivar like Tm-9, Vaune, and TM-21 gave significantly higher seed yield than vertices. The interaction between sowing sate yield was higher sown an 4 October and an 19 October. (Reddy el al.2017).

Surya Kant et al (2017) in a field experiment in the rabisearon of 2016-17 in Hisar, Haryana. India, Brassieajinceacv.varnna, RH=30 and Laxmi were sown 5 or 19 October or 5 November.The yield and yield components generally decreased with delay in sowing, Laxmi gave the higher yield, followed by RH-30 then vanura variety.

Four mustard (Brassica juncea) cultivars (vardhan, tm-4, pusabasat and pusabahar) were evaluated under four sowing dtes (% October, 20 October 5 November and 20 November) in RajendranagrAndrapradesh during winter 2013-14. Sowing mustard an 5October resulted in higher growth, yield and yield components followed by 20 October, 5 and 20 November, with delay in sowing beyond 5 October the reduction in seed yield was 34.6, 67.6 and 88.4% with respective dates. Cv. TM-4 offered significantly higher seed yield (8.25 q/ha) than the rest. Significant interaction between the dates of sowing and cultivars showed that Tm-4 sown on 5 October produced greater seed yield (14.43 a/ha) than the rest.

Gare et al (2016), in a field trial at Rahuri, Maharastra in rabi (winter) 2012-13, brassica jubcia yield decreased as sowing date was delayed from 1st October to November. The also

observed that seed yield averaged 0.93, 0.72 and 0.61 t/ha in cv. Seta (B-85), Pusa Bold and PusaBarani, respectively.

Rajput et al (2016) investigated the effects of sowing date (17 or 27 October 6, or 16 November) and cultivars like Pusa Bold (brassica juncea). Early sowing (October) resulted in significantly higher seed, oil and protein yield and N uptake by the seed compared with late sowings seed, oil and protein yield, N content and N uptake were highest under pre-flowering and siliquae development stage.

Bukhtiar et al (2017), revealed that, Brarricajurcea, B. carinata, B. canpestris, B napus and Eruca sativa were compared under rainfed condition in Punjab in 2015-17. Crops were sown in six different dates at fortnightly intervals between 1 September and mid-November each year. Mean seed yield was highest (1417 kg/ha) when sown at the end of September. B. carinata gave the higher yield of 1518 kg/ha followed by B. Juncea. Ernce sativa gave the lowest yild of 683 kg/ha.

PHYSIOLOGICAL BASIS OF YIELD VARIATIONS:-

Yield of crop can be increased by increasing total dry matter production and simultaneously through increasing harvest index. The farmer and related matter while the later is a consequence of effective partitioning and growth of reproductive structures in rapeseed mustard. Analysis of biomass production dry matter of 18-22 t/ha in rapeseed-mustard was obtained, giving 3-4 q/ha seed yield the harvest index an dry weight basis is low in rapeseed and mustard crop. There four, these is possibility that the yield improvement in this crop will laterally depends on increasing in biomass production rather than by increasing the harvest index an dry weight basis (Bhargava, 2014).

Growth analysis is characterized by accompanying increase in dry weigh of all parts of the plat. Number of leaves reach maximum values 10-12 days before flowering. Maity et al (2010) reported that development after flowering is mainly characterized by a continued increase in total dry weight though leaf area is rapidly declining after flowing.

Low seed yield and oil yield profile of cruciferous rapeseed and mustard complex of crop in this country has made it imperative to breed for higher yield in integrated manner. This approach among other warrant development of plant type concept based on physiological insight and exploitation of morphological and physiological parameters determining productivity.

STAGE OF RAPESEED MUSTARD-

Broadly, there are two distinct growth stages of mustard crop, pre flowering sage or vegetative stage and post flowering stage or productive stage. The differences in the duration of the two growth stages of mustard influence the productivity of this crop largely. Starting from sowing to harvesting, like other oilseed crop, this crop has also four different growth stages, these are: seeding stage, flowering stage. Among this flowering stage in most important and takes a vital role in growth and development of any mustard variety. Most of the mustard varieties flower within 40 to 50 days after sowing and the time to flower is a major factor in determining the time to maturity and the rapid development rates for different growth characters which are positively correlated with each other and with the earlier or crop growth stages.

Generally 3-6 days are required for the emergence of seedlings after some of the crop depending on temperature and soil moisture condition. In Brassiea emergence of seedlings are also affected by seeding depth, soil moisture regime and crust strength (Nuttall, 2012). At shallow seeding depth of 1.5 cm the seedling emergence of rapeseed was significantly higher than 3.0 cm depth. Late planting requires more days to germinate as low temperature retards the process of emergence.

After seedling stage, which a slow growth initially and gradually and gradually it increases, reaching its peak by the ofanthesis. This causes increase in leaf area and an accompanying increase in dry weight of all parts of the plant takes place. Deaf area, number of leaves and leaf dry weight reached maximum values at flowering and there after die live.

At IARI, New Delhi working with two varieties of Brassica napusBhargava (2015) reported that ‘Pusa Bold’ and ‘varuna’ took 54 and 59 days respecting from sowing to flowering;

the Brassica napus varieties took 82 to 83 days. These, it appears that Brassica napus flowered 23 to 28 days later then mustard.

The precise analysis of the sequence of flower and food production within and between inflorescences has revealed by Ttagi et al (2016) and they reported that the period of flower opening over the whale plant of variety, 'Z ollexngold', at England spanned on an average 26 days and more than 75% of the pod which were retained to maturity were formed from flowers which opened within 14 days of an thesis. Most of these flowers were found as the terminal raceme and an the basal and middle regions of the axillary inflorescences at nodes 1,2 and 3. In fact during the formation stage all the flowers do not set fruit and the time required from full flowering to full pod formation vary from place to palace, depending on weather condition.

The harvesting stage is another vital point for yield and particularly for oil yield, Rajput et al (2017) conducted an experiment with six varieties of Indian mustrad harvested at four maturity stages viz. greenish yellow pod, yellow pod, yellowish brown pod and brown pod stage. The oil percentage was higher is the three varieties at the yellow pod stage and at the yellowish brown pod stage in the other varieties. The lost weight of grains was highest at yellow pod stage in five varieties and at the yellowish brown pod stage in one variety. The oil yield was optimum at the yellowish brown pod stage in almost all the varieties. Oil percentage in the first three stages were higher in samples dried in the over on the day of harvesting then in those dried under sun but the reverse trend was obtained in ease of test weight of grains. So for getting optimum yield of oil, yellowish brown pod stage in the best time for harvesting.

At Kanpur, the highest yield of toria was recorded when the crop was harvested at full maturity, closely followed by yellow pod stage. At green pod stage the seed yield was significantly lower then other stage. The oil content was lowest when harvested at green pod stage (cultivation, Techniqne, Summary Report, 2013-15) and invited paper, ICAR, 2015.

VEGETATIVE GROWTH STAGE:-

Thakur et al (2016) reported that, an experiment at Himachal Pradesh Kish Viswavidyalaya, Kangra. Reported that, reported that, plant height decreased with delayed sowing. October sowing produced significantly taller plants than November sowing. Brassica carmatac.v 'HPc-1; attained the maximum height and was significantly superior to all other Brassie asps. During both the years B.napuscv, 'H pN P-1' and Brassica Juncea cv. 'Varuna' attain similar height during 1994-95. However, in 1993-94 B. juncea recorded significantly more height than B. napus. Early planted crop had more primary branches but significant variation was observed during 2014-15 only. Planting an 5th October resulted in significantly more primary branches per plants than other sowing dates. Crop planted in October resulted in more secondary branches per plant than November planting. This could be probably due to the fact that for October- sown crop mean temperature (18.4-23.7°c) was optimum for vegetative growth period pass through mean temperature of 16-18°c. Among various species, B, carinata cv.'HPC-1) had significantly more primary as well as secondary branches per plant than other Brassica sps. Brassica napus cv. 'HPN-1' had significantly lesser secondary branches plant than the other species.

Experiment conducted in west Bengal with mustard variety 'Vauna' by Roy (2015) revealed that highest leaf area index was observed at 60 DAS i.e 10 days after 50% flowering when the crop received 300kg N/ha. The critical leaf area index at which 95% of the light gets intercepted by the foliage appeared to be 4 to 4.5. Reduction in crop growth rate was found at high leaf area index values. Net assimilation rate was found fairly high at post flowering stage because 'varuna' showed increase in siliquae surface area and the green surface area of stems. The growth of stem increased sharply between 30 and 60 DAS. Nitrosan significantly increased the dry matter accumulation. Number of primary branches was not as much influenced as secondary branches.

Nanda et al (2017) conducted a field experiment in 2013-15 in New Delhi with B. campest is cvPusaKalyani and B. juncea cv varuna and sowing was done on 4 dates between 13-14 October and 1-3 December. The value of the expatiation co efficient was higher during the vegetative than the reproductive stage and declared progressively with increasing green area index. Interception of solar radiation was highest in the crop sown in early October and decreased

progressively with later sowings. Light use efficiency was decreased by delayed sowing. Seed yield was positively related to light interception during the reproductive stage.

Sharma et al (2017) observed that path co-efficient analysis was used to determine relationships between different growth parameters and yield components. Seed yield was positively correlated with all parameters measured except leaf weight per plant siliquae weight per plant and stem weight had the most effect on seed yield.

A growth analysis of rain-fed, field grown B. juncea cv. Varuna plants was carried out by Krishnamurthy et al (2018) Uttar Pradesh, in 2012-14. The crop was shown on 27 November in 2012 and on 10 November in 2013. An increase in vegetative growth period remitted due to late sowing. Dry matter and yield of the plats were also increased. Day matter and leaf area index at flowering were positively influenced by the final day matter production. Delayed sowing resulted in high left area index and was maintained for a longer period. The effective area index of the stem was half and of pods was equal to the maximum LAI, CGR in created until flower cessation and then dropped. RGR, NAR and leaf area ratio declined constantly with the increase in age of the plenty. The pod number and seed size varied with the yield.

Taygi et al (2016), observed evaluated three varieties of Indian mustard (Brassica juncea) viz RH-30, Laxmi and Varuna, for phonological development under three sowing dotes (20 October), November and 30 November) at Hisser during Rabi season of 2012-13. Date are tabulated on days taken and leaf units consumed to reach the following phonological stages: emergence, fifth leaf stage, flower initiation lowest pod mere than 2 cm long and fully ripened. Early sowing resulted in early flowering, a longer seed filling period, a longer reproductive phase and, ultimately, a higher seed yield per hectare. Days taken to the first four stages increased significantly as sown as delayed. However, days taken to maturity were reduced following delayed sowings due to high temperature at maturity which resulted in forced maturity. A positive correlation was obtained between seed yield and various phonological phages. Among the varieties, RH-30 was the earliest in attaining various phonological stages, followed by Varuna and Laxmi.

REPRODUCTIVE GROWTH STAGE:

Development after an thesis was characterized by a continued increase in total by weight in spite of a rapidly declining leaf area. Stem, pod and to a lesser degree roots all contributed to the increase in total weight for 35 days after an thesis of Brassica napus variety 'Zollergold', but these after pods were the only organ to become hoarier. It is interesting to note in this connection that the maximum pod surface area, reached 120 days after planting, was similar to the peak leaf area attained 60 days earlier (Tyagi et al 2016).

Roy (2015) while working on mustard variety 'Varuna' in shoot and wild winter condition of West Bengal found that nitrogen application increased siliquae number and thus increased dry matter accumulation ever through leaf area index showed steep decline with the highest dose of nitrogen volume of pods per unit area was as high as 3. The higher yield of seed and oil by increasing the levels of nitrogen were due to greater production of seeds from a large number of pods. Nitrogen induced formation of silique ever at lower nodes. The size of pod was not affected by varying nitrogen levels. Due to effect of higher level of nitrogen the test weight of seeds also did not differ significantly between treatments.

YIELD COMPONENTS AND THEIR VARIABILITY:

Thakur and Singh (2016) reported that, in general, siliquae per plant seeds per siliquae and 1000 seed weight decreased with delayed planting. Sowing date significantly affected number of siliquae per plant and seeds per siliquae during experimental years. However, it had significant effect on 1000 seed weight in one year only. Sufficient rainfall coupled with better temperature during 1st year resulted in more siliquae per plant compared with 2nd year. During 1st year crop season total 13 days and maximum clear sky days were available during reproductive stage. Slightly higher rainfall coupled with low temperature, 28 rainy days and cloudy weather during reproductive stage resulted in less growth and siliquae per plant during 2nd year. October planted crop produced significantly more siliquae per plant and seeds per siliquae than November planted are during both the years. Similar results were obtained for 1000 seed weight during lst year only. Brassica carinata had significantly more siliquae than other species, followed by

Brassica napus. However, B. napus had significantly more seed per siliquae. B. campsites and B. juncea remained statically at par in respect of siliquae per plant and seeds per siliquae. October planting dates produced bold seeds as reflected in 100- seeds weight (3.78 g) and this pare meter decreased in November sowing. Among the different cultivars, 'Varma' had the highest 1000 seed weight, where as, 'HPN-1' the lowest 1000 seed weight.

At I.A.R.I, New Delhi, recent experiments on mustard variety.Varuna and 'pusa Bold' by Bhargava (2015) revealed that removal of secondary/ tertiary branches led to increase in number of primary branches, which in turn resulted in increase in pod number, pod weight, seed weight and test weight of diversion of assimilates to primary branches. It is likely that at high plant densely most of the pods were on the main and primary branches and there these may be in a favorable position to intercept solar radiation, this might have resulted in more efficient supply and distribution of assimilates. He also reported that variety 'varuna' and 'puse Bold', when grown in isolation had 143 and 201 branches, 1953 and 2158 pods number, 485 and 551 go pod weight, 249 and 289 seed weight, respectively. In addition, the total dry matter at harvest was 771 and 856g, respectively which were relatively high. Harvest index ranged between 32% and 33% in both cultivars. Oil percentage in two cultivars was 41% to 42%.

CONCLUSION

In case of test weight of grains were reduced due to delayed sowing. The crops sowing a reduction of 101, due to delay in sowing between third and forth date of sowing. The varietal differences in test weight of grain were also significant and appreciable. The two medium duration bold seeded varieties like 'Pusa Bold' and PusaBuraun' and TM – 4 had higher test weight of grains as compared to other varieties in all the years. The interaction of dates of sowing and varieties were significant. It is also found that for thousand seeds weight middle week of November to last week of November sowing time are appropriate but reduction maximum seed weight due to delay between third and forth dates of sowing.

Seed yield of mustard varieties significant difference between the varieties and also between the dates of sowing. The highest yield was recorded when the crops are grown on the middle week

of October. When crops were sown middle week of November the seed yield was not better than middle week of October sowing. Two-week delay in sowing caused about a reduction of yield to the tune of variety 3.5 – 4.5 qt/ha, it meant about 27% reduction in the yield. The interaction between dates of sowing and varieties was significant in all the successive years. Some of the varieties like 'B – 85', 'Pusa Buran', 'B – 9' and 'Pusa Bold' showed greater reduction in yield than other due to late sowing.

Every sowing increased the oil yield irrespective of any variety oil yield was reduced by 7.8 – 8% for the fortnight delay in sowing and by 12.9 – 13.1% for a month delay in sowing. Interaction between sates of sowing and varieties was significant in all the successive years. The all varieties showed greater reduction of oil yield due to late sowing of crops. About 2% oil content was reduced and in between last week of October and last week of November. Analysis of unsaturated fatty acid profiles showed that erucie acid and linolenic acid decreased and linoleic acid sowing of crop. Acid increased due to late sowing of crops.

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