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RESEARCH ARTICLE

Investigation on diseases of jute seed crop and possibility of seed production in West Bengal

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ABSTRACT: Field experiment was conducted for disease-free quality jute seed production during 2009-2012 by altering the sowing dates and fungicide scheduling. Among seven dates of sowing, mid-August sown crop resulted in least seed infection (1.7%) by *Macrophomina phaseolina* and seed discolouration by various seed fungi. Other quality parameters like germination (88.2-91.50%) and seedling vigour also remain above the seed recommended standard (80%). Seed yield (13.2 q/ha) and yield attributes are also higher in mid-August sown crop than other dates of sowing. Foliar spraying of carbendazim 50WP @ 0.2% at pod setting or pod maturation stage resulted in least seed infection (2.3%) and seed discolouration which reflected on higher seed yield (11 q/ha) and yield attributes. The qualities of seeds are also improved due to foliar application of fungicide, carbendazim.

Key words: Jute, diseases, management, seed borne infection, seed discolouration, fungicide

Jute is an important eco-friendly commercial bast fibre crop grown mainly in South East Asian countries particularly in India and Bangladesh. Global production of raw jute is around 30 lakh tonnes. Developing countries contribute 29.90 lakh tonnes (99.97%) of the world's production and 92.5% of the contribution is from India (17.82 lakh tonnes) and Bangladesh (9.90 lakh tonnes). India ranks first in terms of area (0.8 million ha) and production. Although West Bengal contributes about 80% of total jute fibre production in India, jute seeds for internal consumption (5000 t) as well as export (3500 t) to Bangladesh are mostly produced in other states such as Andhra Pradesh, Maharashtra, Gujarat and Karnataka (Saha, 2004). Thus timely supply and procurement of quality seed is a serious handicap to fibre producing eastern states of the country. Of late, the jute seed producing states are opting for more remunerative crops like summer maize, vegetables etc. necessitating jute seed production in the fibre producing states itself. Earlier it was thought that jute seed production in West Bengal is not possible because of seed borne infection of *Macrophomina phaseolina* and *Colletotrichum gloeosporioides* and low productivity of seed. Such observation was based on collection of seeds from the crop sown during March-April for fibre purpose. Under these backdrops, field experiment was carried out at ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore (ICAR-CRIJAF), to assess the diseases of jute seed crop and explore the possibility of jute seed production in West Bengal.

MATERIALS AND METHODS

Assessment of diseases of jute seed crop

Four jute (*Corchorus olitorius*) varieties namely JRO 8432, JRO 524, JRO 128 and S 19 were sown in mid-August, 2008 following randomised block design (RBD) with four replication at research farm of ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore (88.43^{0}E and 22.75^{0}N). Incidence (%) of different diseases like root rot, stem rot (*M. phaseolina*) and anthracnose (*C. gloeosporioides*) was recorded in demarcated area (4 m x 3 m) leaving the border rows at 75, 90 and 105 days after sowing. The data were analysed using the statistical programme MSTATC. Incidence of seed borne fungi was determined by agar plate as well as blotter paper method (ISTA, 1996) and seed discolouration was assessed by visual observation. Qualities of seeds were tested both in standard blotting paper method as well as in field condition in terms of germination, pre-emergence rotting, post-emergence rotting of seedling and vigour index [(vigour index = germination x (root length and shoot length)].

Production of quality seed

To study the effect of sowing dates (D1= mid-June, D2= end-June, D3=mid- July, D4=end-July, D5=mid-August, D6=end-August and D7=mid-September) and fungicide application schedule [(spraying of carbendazim 50 WP @ 0.2% at pod setting (S1) and pod maturation stage (S2)] on producton of quality seeds, field experiment was designed in split plot design with three replications with plot size 7m x 3m at ICAR-CRIJAF farm, Barrackpore (88.43^{0}E and 22.75^{0}N, soil pH-6.8, soil texture- sandy loam, organic carbon- 1.21%, soil nitrogen-254 kg/ha, soil Phosphorus-72.3 kg/ha and soil Potassium-351 kg/ha). To raise the crop, normal agronomic practice (seed rate 4 kg/ha, pre-emergence application of butachlor @1.5 kg a.i, one hand weeding at 20-25 days after sowing, spacing – 40 cm x 10 cm, topping at 50 days of sowing for first five dates of sowing, NPK application @ 60:40:40, irrigation - as and when

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required) was followed (Singh *et al*., 1984; Bhattacharjee *et al*., 2000). Observation on yield attributes like bearing nodes, pod/plant and seed/pod were made as per standard procedure at the time of harvesting.

After harvesting the seeds, random sampling was made and incidence of seed borne infection by *Macrophomna phaseolina* (Tassi) Goid was determined by blotter paper method (ISTA, 1996). Similarly, the extend of seed discolouraton was estimated by visual observation. Various fungi from discoloured seed were isolated in PDA agar media using standard isolation protocol. Identification of isolated fungi was made on the basis of culture character, sporulation and conidial characters (Subramanian, 1971; Ahmed and Reddy, 1993). Quality parameters like seed germinaton and seedling vigour in terms of vigour index [(vigour index = germination x (root length and shoot length)] were tested in standard blotting paper method.

RESULTS AND DISCUSSION

Assessment of diseases of jute seed crop

The study revealed that the extend of root rot, stem rot and anthracnose of jute under natural conditions are 2.2-6.5%, 4.6-8.3% and 11.8-19.5% respectively. Whereas, the seed infection due to of *M. phaseolina* and *C. gloeosporioides* varied from 1.5-2.2% and the extend of microbial seed discolouration is about 5.0%. The incidence of root rot (2.2-6.5%), stem rot (4.6-8.3%) and anthracnose of jute (11.8-19.5%) was significantly increased with the age of the crop starting from 70 days after sowing (Fig. 1). Varietal difference of different diseases was recorded with maximum incidence of root rot and stem rot in JRO 524. Whereas, the maximum incidence of anthracnose (28.0%) in JRO 8432 followed by JRO 524 (16.0%). Under field conditions, germination and vigour of apparently healthy seeds remains above the certified standard.

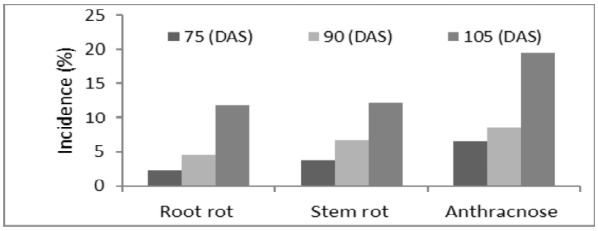

Fig. 1. Assessment of jute diseases in different growth stages

Production of quality seed

Among seven dates of sowing, mid-August and mid-September sown crop resulted in least seed infection (1.7%) by *M. phaseolina* than other dates of sowing (Table 1). Seed discolouration caused by seven different fungi namely *M. phaseolina*, *C. gloeosporioides*, *Aspergillus niger, Fusarium* sp, *Penicillium, Curvularia* and *Dresclera* sp. was significantly reduced in later dates of sowing i.e. end July to mid-September (11.9 to 7.7 discoloured seeds/pod). Germination of seeds developed from different dates of sowing do not differed significantly and varied from 88.2-91.5%. In all the cases the germination of seeds remains above the recommendation standard level. No significant difference in seedling vigour (varied from 570-636.3) was recorded among various dates of sowing. However, seeds of the crop sown during mid-August to mid-September showed better seedling vigour (636.3-630). Initially pod is affected by fungi including *M. phaseolina* and *C. gloeosporioides* which later on invade the seed inside the pod causing seed infection as well as seed discolouration (Sarkar *et al.,* 2013; Sakar and Satpathy, 2014; Sarkar *et al*. 2014). The extent of infection depends on the existing weather conditions particularly high

Table 1. Effect of dates of sowing and spraying of carbendazim 50 WP @ 0.2% on seed infection, discolouration, germination and seedling vigour of jute seed pool (mean of three years 2009-2012 data)

Treatment	Seed infection %	Discolored Seeds/pod	Germination (%)	Seedling vigour
Dates of sowing				
D1= Mid-June	3.8	22.0	88.2	570.0
D2= End-June	3.1	15.3	90.2	581.6
D3= Mid-July	2.9	15.1	90.6	575.0
D4=End-July	2.2	11.9	88.4	599.0
D5=Mid-Aug	1.7	11.4	89.7	636.3
D6= End-Aug	1.8	9.9	91.0	630.0
D7= Mid-Sept	1.7	7.7	91.5	620.0
C.D (p=0.05)	0.3	2.6	NS	NS
Stage of fungicide (carbendazim 50 WP@ 0.2%) spray				
S1= Pod setting	3.2	14.2	91.1	622.6
S2=Pod maturation	2.3	11.8	91.3	681.3
S3= No Spray	3.5	16.8	86.0	583.0
C.D. (p=0.05)	1.1	2.3	1.87	26.2

Table 2. Effect of dates of sowing and spraying of carbendazim 50 WP @ 0.2% on yield and yield attributes of jute seed (pool mean of three years 2009-2012 data)

Treatment	Bearing nodes	No. of pods/ Plant	No. seeds/ Pod	Yield (q/ha)
Dates of sowing				
D1= Mid-June	30.6	33.2	172.8	8.1
D2= End-June	38.8	37.6	190.3	9.5
D3= Mid-July	36.2	32.4	200.3	10.03
D4= End-July	39.6	35.2	205.4	12.2
D5= Mid-Aug	48.7	44.7	216.4	13.2
D6= End-Aug	42.2	37.7	208.9	11.8
D7= Mid-Sept	36.2	30.6	211.1	8.8
C.D. (p=0.05)	4.43	6.0	12.8	1.3
Stage of fungicide (carbendazim 50 WP @ 0.2%) spray				
S1= Pod setting	38.8	39.2	197.6	10.9
S2= Pod maturation	36.2	38.7	202.4	11.0
S3=No Spray	39.6	35.1	189.8	9.8
C.D. (p=0.05)	48.7	2.6	6.2	0.32

temperature and relative humidity (RH). With the delaying in sowing time the temperature and RH reduced at pod setting stage (Rao, 1979,1980) which might be reduced the seed infection and discolouration. Bhattacharjee *et al.* (2000) also reported that quality of seed like germination viability as well boldness remains unaffected with delay in sowing.

Spraying of carbendazim 50 WP @ 0.2% at pod maturation stage reduces the seed infection (2.3%) as compared to without spray (3.5%) (Table 1). Similarly seed discolouration reduced significantly when sprayed at pod setting (14.2/pod) and pod maturation (11.8/pod) compared to control (16.8/pod). Spraying of fungicide either in pod setting or pod maturation stage significantly improved the germination (91%) and seedling vigour (622.6-681.3). In jute, pod infection lead to seed infection and seed discolouration. The microclimatic condition inside the pod is highly congenial for internal growth and development of fungi, therefore, foliar application of carbendazim 50 WP @ 0.2% at pod setting or pod maturation stage prevented the seed infection as well as seed discolouration. In many seed crops, spraying of fungicides at pod bearing or maturation stage not only reduced the seed infection and discoloration but also improved the seed quality like germination and vigour index (Agarwal, 2006) but such information are not available in jute crop.

Yield attributing parameters i.e. number of bearing nodes (30.6-48.7), number of pod/plant (30.6-44.7) and numbers of seeds/pod (190-216) were significantly higher in later dates of sowing than mid-June sown crop (Table 2). In mid-August sown crop the number of bearing nodes (48.7), number of pods/plant (44.7) and numbers of seeds/pod (216) was the highest. The seed yield which varies between 8.1-13.2 q/ha was significantly differ with sowing dates with maximum yield in mid-August sown crop (13.2q/ha) followed by end-July (12.2 q/ha) and end August (11.8 q/ha) sown crop. Singh *et al.* (1984) and Saha (2004), reported that yield and yield attributes increased with delayed in sowing time but they tried upto July only and that to in clay soil conditions which resulted in poor seed yield i.e. 3-5 q/ha which was uneconomical.

Significant impact of spraying of fungicide either at pod setting or pod maturation stage was recorded on bearing nodes, pods/plant and seeds/pod which reflected on seed yield (11.0 q/ha) than the control (9.8 q/ha) where no fungicide was sprayed (Table 2).

Thus sowing of jute seed crop during mid-August followed by foliar spray of carbendazim 50 WP @ 0.2% at pod maturity stage was the most effective recommendation for maximization of quality jute seed with higher benefit cost ratio (B:C=2.50-2.90) the existing practice of rice cultivation.

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