

Effect of Plant Population Density and Sowing Methods on Stem Rot of Jute (*Corchorus olitorius*, *C. capsularis*) Caused by *Macrophomina phaseolina* (Tassi) Goid.

Rajib Kumar De^{1*} and A.N. Tripathi¹

ABSTRACT: In order to find out optimum plant density with better sowing method to lower the jute stem rot, incited by *Macrophomona phaseolina* causing high plant mortality, a field experiment was carried out in at CRIJAF main farm at Barrackpore in India with two sowing methods, namely, broadcast and line sowing and varied plant population density (3–10 lakhs/ha) of jute. With increasing plant population density the incidence of stem rot increased reaching peak of 16.3 and 27.4% in highest plant population density of 10 lakh per ha, respectively, in broadcast and line sown crop. Lowest stem rot of 5.4 and 7.4% was observed in line sown and broadcast crops with very low population density of 3 lakh per ha. Under optimum plant population level of 5–6 lakh per ha stem rot incidence was moderate with 7 – 9% in line sown and 10–17% in broadcast crops. With similar level of plant population, jute stem rot was always low in line sown crops than their counter part in broadcast crops. Progress of jute stem rot over the crop growth period in line sown crop with low plant density (3 lakhs /ha) the disease increased from initial low level of 0.2% at 30 DAS to 3.7% at 90 DAS and finally to 5.4% at 120 DAS. But at 5-6 lakhs /ha the disease increased from initial low level of 0.1% at 30 DAS to 3-4% at 75 DAS, 4-6% at 90 DAS and finally reached to 7-9% at 120 DAS. In broadcast crop with highest plant density of 10 lakhs /ha, the jute stem rot began with 0.7% at 30 DAS, increased to 5, 15, 20% at 60, 75, 90 DAS, respectively, and finally reached a peak of 27.4% at the harvest stage of the crop at 120 DAS.

Keywords: Stem rot of jute, *Corchorus olitorius*, *C. capsularis*, *Macrophomina phaseolina*, population density and sowing methods.

INTRODUCTION

Rampant use of hazardous pesticides on crops including food and fruit crops led to rise in level of environmental pollution, pesticide residue in food chain, unusual diseases in human, finally a serious threat to biodiversity. Minor manipulation of traditional agronomic practices often becomes fruitful in order to manage plant diseases. Jute farmers' age old belief that high plant population with broadcasting seeds to save cost of manual labour ultimately take the toll in yield and quality of fibre by increasing plant density and incidence of stem rot caused by *Macrophomona phaseolina*, thereby causing high plant mortality.

Jute (*Corchorus olitorius* L. and *C. capsularis* L.), also known as 'golden fibre', is one of the important commercial fibre crops of India and grown mostly in its eastern region with an area of 0.91 million hectares and production 11.82 million bales (one bale = 180 kgs) dry fibres with fibre productivity of 2349 kg per hectare. It is cultivated as pre-kharif crop mainly in the states of West Bengal, Bihar and Assam with percentage contributions to National production of jute fibres are 79.54, 10.80 and 6.22, respectively. Recently jute has emerged with stronger attributes due to its eco-friendliness with more oxygen producing, carbon dioxide absorbing and higher fuel wood producing capabilities, apart from its biodegradable diversified products.

¹ Division of Crop Protection, ICAR - Central Research Institute for Jute and Allied Fibres (CRIJAF), (Indian Council of Agricultural Research), Nilganj, Barrackpore, Kolkata 700120, West Bengal. Website: www.crijaf.org.in

* E-mail : rkde@rediffmail.com

Out of all diseases of jute plant, stem rot of jute caused by *Macrophomina phaseolina* (Tassi) Goid. is economically the most important affecting both yield and quality of fibre in both cultivated species, namely, *C. olitorius* L. and *C. capsularis* L. Although stem rot is the common name but the pathogen attacks any part of the plant at any stage of growth right from germination to harvest producing various symptoms, like, damping-off, seedling blight, leaf blight, stem rot, collar rot, root rot and spot on pod especially in seed crop. The disease is seed, soil as well as air borne and continues to damage the crop in all jute growing areas in India and other countries starting from germination to maturity in both seed and fibre crops. Hence, management of jute stem rot targets manipulation of soil, pre-sowing seed treatment and foliar spraying of fungicides or judicious combination of all. The average loss of yield in jute due to the diseases is around 10-20%.

Tossa jute being most widely cultivated in all the jute growing areas, this investigation has been undertaken to determine the optimum plant density with better sowing method for managing stem rot disease in the field.

MATERIALS AND METHODS

In order to find out optimum plant density with better sowing method to lower the jute stem rot, a field experiment was carried out in randomized block design with three replications with two sowing methods, namely, broadcast and line sowing and

varied plant population density (3- 10 lakhs/ha) on a new jute variety, JRO 8432 at main farm of CRIJAF, Nilganj, Barrackpore, India during normal cropping season. Normal jute crop management practices including fertilizers, manual weeding, etc. were followed except plant density and sowing method as per different treatments. Percentage incidence of stem rot was noted at fortnightly intervals starting from 30 days after sowing (DAS) after final thinning of crop. No other plant protection chemical was applied.

RESULTS AND DISCUSSION

It was observed that with increasing plant population density the incidence of stem rot increased reaching peak of 16.3 and 27.4% in highest plant population density of 10 lakh per ha, respectively, in broadcast and line sown crop. Lowest stem rot of 5.4 and 7.4% was observed in line sown and broadcast crops with very low population density of 3 lakh per ha. Under optimum plant population level of 5-6 lakh per ha stem rot incidence was moderate with 7-9% in line sown and 10-17% in broadcast crops.

With similar level of plant population, jute stem rot was always low in line sown crops than their counter part in broadcast crops. In 3 lakh per ha plant density stem rot incidence increased from 5.4% in line sown crop to 7.4% broadcast crops. Stem rot increased from 13.6% in line sown crop to 23.4% broadcast crops in 8 lakh per ha plant density level. With high plant density of 10 lakh per ha stem rot

Table 1
Effect of plant population density and sowing methods on stem rot of jute

Treatments	Sowing	Plant population /ha in lakh method	Incidence of stem rot of jute									
			30 DAS		60 DAS		75 DAS		90 DAS		120 DAS	
			% Value	Arc sin value*	% value	Arc sin value*	% value	Arc sin value*	% value	Arc sin value*	% value	Arc sin value*
T1	Line sowing	3.06	0.22	2.63	2.06	8.24	2.76	9.56	3.73	11.13	5.41	13.45
T2	Line sowing	5.04	0.11	1.55	1.61	7.30	3.23	10.30	4.89	12.75	7.47	15.86
T3	Line sowing	6.00	0.17	2.35	1.94	7.99	4.39	12.08	6.66	14.95	9.57	18.01
T4	Line sowing	8.00	0.21	2.60	2.90	9.79	8.16	16.58	10.88	19.26	13.62	21.65
T5	Line sowing	10.00	0.49	3.95	3.64	10.95	10.22	18.63	13.02	21.14	16.38	23.85
T6	Broadcasting	3.06	0.22	2.63	1.80	7.67	2.71	9.42	4.99	12.90	7.49	15.87
T7	Broadcasting	5.04	0.21	2.62	2.03	8.14	4.22	11.84	6.84	15.16	10.26	18.67
T8	Broadcasting	6.00	0.31	3.14	3.13	10.18	8.24	16.67	12.48	20.67	17.91	25.02
T9	Broadcasting	8.00	0.61	4.41	4.04	11.58	9.06	17.50	15.56	23.22	23.46	28.96
T10	Broadcasting	10.00	0.74	4.91	5.57	13.63	15.54	23.21	20.95	27.23	27.41	31.55
	CD (P = 0.05)		-	1.32	-	1.45	-	1.37	-	1.19	-	1.87
	SEm+		-	0.63	-	0.69	-	0.65	-	0.57	-	0.89

*Figures in this column represent Arc sin angular conversion values.

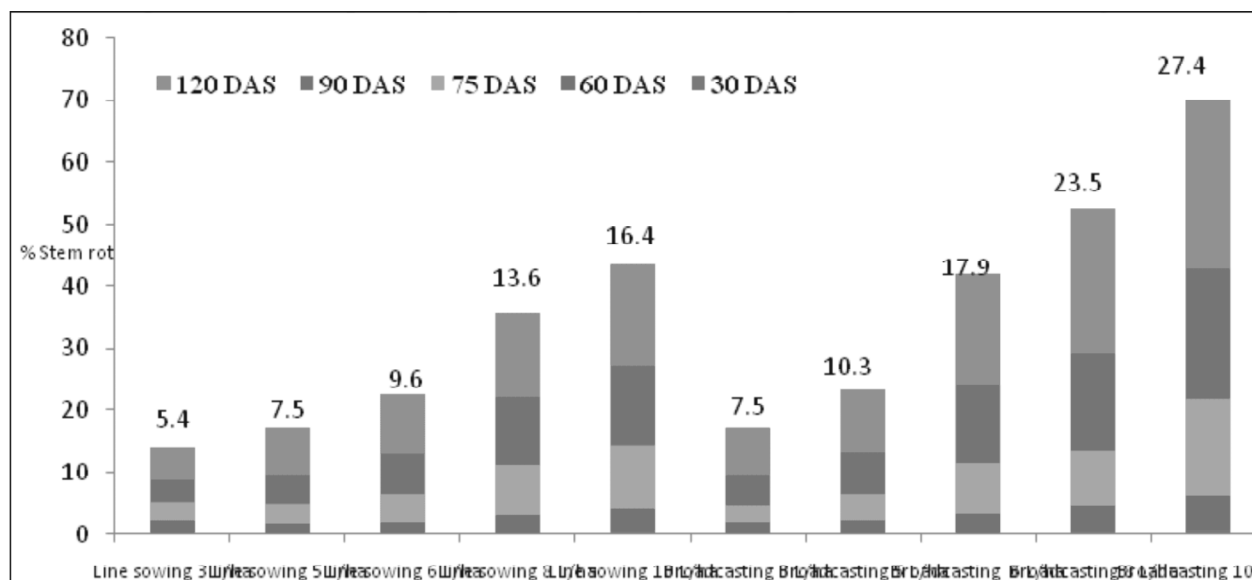


Figure 1: Effect of plant population density and sowing methods on stem rot of jute

incidence reduced to 16.3% in line sown crop from 27.4% broadcast crops (Table 1, Figure 1). When the progress of jute stem rot over the crop growth period was considered, it was observed that in line sown crop with low plant density of 3 lakhs /ha the disease increased from initial low level of 0.2% at 30 DAS to 2.7% at 75 DAS, 3.7% at 90 DAS and finally to 5.4% at 120 DAS. But at 5-6 lakhs /ha the disease increased from initial low level of 0.1% at 30 DAS to 3-4% at 75 DAS, 4-6% at 90 DAS and finally reached to 7-9% at 120 DAS. In broadcast crop with highest plant density of 10 lakhs /ha, the jute stem rot began with 0.7% at 30 DAS, increased to 5, 15, 20% at 60, 75, 90 DAS, respectively, and finally reached a peak of 27.4% at the harvest stage of the crop at 120 DAS.

Reports of use of various methods for reducing jute stem rot are available. Among different methods of management of jute stem rot, use of botanicals (De [2]; Choudhury *et al.*, [1]), fungicides (De, [4, 8]; De *et al.*, [14]), bleaching powder or calcium hypochlorite [$\text{Ca}(\text{OCl})_2$] (De *et al.*, [13]), host resistance (De and Mandal, [10, 11]), wild relatives (De, [7]), balanced NPK fertilizer (De, [6, 9]), and manipulation of date of sowing (De, [3, 5]) were most important. Seed infection and its management in jute were reported by De and Mandal [12].

By shifting sowing method to line sowing from traditional broadcasting and adjusting the plant population up to 5-6 lakhs /ha by thinning, the stem rot of jute may be managed to some extent. It may be proved beyond doubt that line sowing with

similar level of plant population density reduced stem rot due to better aeration or ventilation and allowing more space per plant. CRIJAF developed multi row jute seed drill and it optimized both plant population (up to 5-6 lakhs/ha without thinning) and seed rate of 2-3 kg/ha (instead of traditional 5-6 kg/ha) with free additional benefit of decreasing stem rot thereby reducing the cost of jute fibre production.

REFERENCES

- Choudhury, H.; De, R.K.; Sarkar, S.K.; Selvaraj, K.; Chakraborty, L. and Kundu, D.K. (2014), Effects of plant essential oils against stem rot pathogen of jute. Paper presented in the International Conference on Natural Fibres (Theme: Jute, and allied fibres) held on August 1-3 at Kolkata, India, pp.219.
- De, Rajib Kumar. (2012)a, Botanicals as good alternative to manage stem rot of jute (*Corchorusolitorius* L.C. *capsularis* L.) caused by *Macrophominaphaseolina* (Tassi) Goid. Paper presented at National symposium on Blending conventional and modern plant pathology for sustainable agriculture held at Indian Institute of Horticultural Research, Hesaraghatta Lake Post, Bangalore 560089 on 4-6 December, 2012 P10 p 130.
- De, Rajib Kumar. (2012)b, Influence of date of sowing date on stem rot of jute (*Corchorusolitorius*L.) caused by *Macrophominaphaseolina* (Tassi) Goid. Paper presented in the National symposium on blending conventional and modern plant pathology for sustainable agriculture held on 04-06 December at Indian Institute of Horticultural Research, Bangalore, India. pp. 99-100.

- De, Rajib Kumar. (2012)c, Search for new fungicides against stem rot of jute. Paper presented at National symposium on Plant microbe interactions and crop health management held at Visva-Bharati, PalliSikshaBhavana (Institute of Agriculture), Sriniketan 731236, West Bengal on 6-7 October, 2012 OP:T-V-13 pp 65-66.
- De, Rajib Kumar. 2013. Effect of date of sowing on the incidence of stem rot caused by *Macro phomina phaseolina*(Tassi) Goid. *Journal of Mycopathological Research* **51**(2): 252-258.
- De, RajibKumar. (2014)a, Effect of nitrogen, phosphate and potashfertilizer on stem rot of jute (*Corchoru solitorius* L. and *C. capsularis* L.) caused by *Macro phominaphaseolina* (Tassi) Goid. In Proceedings of the National symposium on plant pathology in genomic era held on May 26-28 at Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhatisgarh p 108 (TS13-PO 20).
- De, Rajib Kumar. (2014)b, Evaluation of wild species of jute (*Corchorus spp.*) against stem rot caused by *Macrophominaphaseolina* (Tassi) Goid. Paper presented in the International Conference on Natural Fibres (Theme: Jute, and allied fibres) held on August 1-3 at Kolkata, India, pp.217.
- De, Rajib Kumar. (2014)c, Search for new fungicides against of stem rot of jute (*Corchorusolitorius* L. and *C. capsularis* L.) caused by *Macrophominaphaseolina*(Tassi) Goid.*Journal of Mycopathological Research* **52**(2): 217-225.
- De, Rajib Kumar. (2015), Increase of stem rot of jute (*Corchorusolitorius* L.) caused by *Macro phomina-phaseolina* (Tassi) Goid. with more nitrogenous and reduction with phosphatic and potassic fertilizers. Paper presented in National conference on "Indigenous innovation and foreign technology transfer in fertilizer industry: needs, constraints and desired simplification" held on 17 January, 2015 at ICAR-CRIJAF, Barrackpore, Kolkata. p. 47(P-15).
- De, Rajib Kumar and Mandal R K. (2012)a, Four *Corchorusolitorius*L. lines resistant to stem rot pathogen *Macrophominaphaseolina* (Tassi) Goid. *Journal of Mycopathological Research* **50**: 126.
- De, Rajib Kumar and Mandal R K. (2012)b, Identification of resistant sources of jute (*Corchorusolitorius*L.) against stem rot caused by *Macrophominaphaseolina* (Tassi) Goid. *Journal of Mycopathological Research* **50**: 217-222.
- De, Rajib Kumar and Mandal R K. (2012)c, Seed infection of jute (*Corchorusolitorius*and *C. capsularis*) and its management. *J. Mycol. Plant Pathol.* **42**(4): 541.
- De, Rajib Kumar., Ghorai, A.K., VinayKumar and Mandal, A.(2014), Bleaching powder [$\text{Ca}(\text{OCl})_2$], an ecofriendly alternative for management of stem rot of jute (*Corchorusolitorius* L. and *C. capsularis* L.) caused by *Macrophominaphaseolina* (Tassi) Goid. Paper presented in International Symposium on "Role of fungi and microbes in the 21st century - A global scenario" held on 20-22 February, 2014 Science City, Kolkata. p 51.
- De, Rajib Kumar.; Hembram, S. and R.K. Mandal. (2010), Evaluation of new fungicides on *Macro phomina-phaseolina* causing stem rot of jute. *Pestology* **XXXIV**: 39-44.

○○○