Effect of nutrients on populations of rhizosphere mycoflora of Jute (*Corchorus olitorious* L.)

S.K. SARKAR, DIPANKAR MANDAL AND BIJAN MAJUMDAR

J. Mycopathol, Res, 56(3) : 209-212, 2018;
ISSN 0971-3719

Department of Botany,
University of Calcutta,
Kolkata 700 019, India

J. Mycopathol. Res. ***56(3)*** *: 209-212, 2018;* (ISSN 0971-3719)

Effect of nutrients on populations of rhizosphere mycoflora of Jute (*Corchorus olitorious* L.)

S.K. SARKAR*, DIPANKAR MANDAL AND BIJAN MAJUMDAR[1]
Division of Crop Protection,ICAR-Central Research Institute for Jute and Allied Fibres Barrackpore, Kolkata 700120

Received : 20.04.2018 RMs Accepted : 29.08.2018 Published : 29.10.2018

Application of nutrients plays an important role on biological properties of soil particularly in rhizosphere soil. Two years (2008-10) field experiment was conducted at ICAR- Central Research Institute for Jute and Allied Fibres, Barrackpore to study the effect of different fertilizer/manure on rhizosphere microbial population in jute (*Corchorus olitorius,* cv. JRO 524). The result indicated that in all the treatments the population of rhizosphere mycoflora increased at the initial growth stage and thereafter the population started declining (1.48 - 6.72 - 5.59 cfu/g dry soil X 10^4 at 0, 30 and 60 days after sowing respectively). The total mycoflora count at the initial stage (before sowing) is 0.95-2.25 cfu/g dry soil X 10^4, at 30 days after sowing (DAS) it varied from (3.1- 9.4cfu/g dry soil X10^4) depending on nutrient treatment. Initial increase in microbial population is due to root exudation and chemical stimulation which are highly influenced by the addition of nutrients in different treatments. At 60 DAS the population declined in all the treatments (2.6 to 6.5 cfu/g dry soil X10^4). Similar trend was also recorded in population of beneficial fungi (*Aspergillus* spp, *Trichoderma* spp and *Pencillium* spp). Among all the treatments application of recommended dose of fertilizer along with 10t farm yard manure (FYM) resulted in better growth and population buildup of different mycoflora including beneficial ones in jute rhizosphere.

Key words: Jute, *Corchorus olitorius*, rhizosphere, nutrient, mycoflora

INTRODUCTION

The rhizosphere is a region around plant roots where simple sugars, amino acids and many other compounds are exudates by the plant and are available to the microorganisms . Numerous microorganisms (both harmful as well as beneficial) are co-existed and proliferated in response to the root exudates in a harmonious manner in soil rhizosphere. A soil fungus plays an important role in nutrient recycling, plant health and development . Biological control of soil-borne pathogen is operating inside the soil since time immemorial. Generally soil borne pathogens are in a suppressive stage due to various bio-control mechanisms (competition, antagonism, myco-parasitism etc.) operated in the soil . But soil is hungry in terms of nutrients availability which hinders the germination of microbes in the soil and making them biologically inactive i.e. fungistatic stage. Root exudates are affected by various factors like soil edaphic factors, available soil nutrients, growth stage of the plants etc. Addition of nutrients in the form of fertilizer or organic manure annul the fungistasis and plays an important role in keeping a balance between beneficial as well as pathogenic microbes in rhizosphere zone and at the same time determine the performance of any crop in terms of economic yield. Keeping this in mind two years (2008-09) field experiment on effect of different fertilizer/ manure on population of jute rhizosphere fungi has been carried out at research farm of Central Research Institute for Jute and Allied Fibres, Barrackpore, West Bengal.

MATERIALS AND METHODS

Conducting field experiment

Two year (2008-10) field experiment with replicated randomized block design was conducted at ICAR-

*Corresponding author : surjapath@gmail.com

Central Research Institute for Jute and Allied Fibres, Barrackpore, West Bengal, India (88.43^{0}E and 22.75^{0}N) to study the effect of different fertilizer/organic manure treatments [(T1= control, T2= 50% NPK of RDF i.e. recommended dose of fertilzer, T3= 100% NPK of RDF (+ sulphur), T4=100% NPK of RDF (- sulpher), T5= 100% NPK of RDF - ZnSo4, T6= 100% NPK of RDF +10 t FYM, T7= 150% NPK of RDF, T8= STCR, based fertilizer dose, T9= cultivated fallow) on jute rhizosphere microbial population. The sources of inorganic fertilizer are urea for nitrogen, single superphosphate for phosphorus and muriate of potash for potassium. To raise the jute crop (cv. JRO 524) normal agronomic practices were followed (seed rate 4kg/ha, spacing – 25 cm (row to row) x 5-10 cm (plant to plant), one hand weeding at 20-25 days after sowing, , irrigation - as and when required).

Properties of soil condition at experimental site

Soil texture was recorded using Bouyoucos hydrometric method. pH of the soil samples was recorded using an electronic digital pH meter. Organic carbon was measured. Total N, available P and K was determined by Kjeldahl method, Olsen's method and flame photometer method respectively.

Collection of soil sample

The rhizosphere soil samples from each treatment were carefully collected at sowing time (0 DAS), 30 DAS and 60 DAS by uprooting a plant and shaking the soil adhering to the roots into a sterile polythene bag. These soils were processed properly and make powdery before use for isolation of fungus.

Isolation of fungi

Serial dilution plating techniques were followed for isolation of rhizosphere mycoflora in Martin's Rose Bengal Agar . Soil sample (1.0 g) was suspended in 9 ml sterilized double distilled water and shacked thoroughly and appropriate dilution was prepared. 1.0 ml aliquots were poured onto sterilized Petri dishes. Each dilution was replicated thrice and plates were incubated at 28±1 ^{0}C in BOD. After three days of incubation, the total fungal colony forming unit cfu/g soil were recorded using digital colony counter.

Identification Manual

Pure cultures of the fungi were made by several sub-cultures. Identification of fungi were made on the basis of culture characters, sporulation and conidial characters.

RESULTS AND DISCUSSION

The rhizosphere soil of experimental site (typic ustochrept) was sandy loam in texture with 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.

Ten different species of fungi, namely, *Alternaria, Rhizopus, Fusarium, Trichoderma, Aspergillus, Mucor, Penicillium, Curvularia, Cephlosporium, Cladosporium* were isolated from jute rhizosphere soil. The result presented in Table 1 indicated that in all the treatments, the mean population of rhizosphere mycoflora (total count) increased at the initial growth stage and thereafter the population started declining (1.48 -6.72-5.59 cfu/g dry soil X 10^4 at 0, 30 and 60 DAS). The total mycoflora count at the initial stage is 0.95-2.25 cfu/g dry soil x10^4, at 30 days crop stage it varied from (3.1 in T9 to 9.4 in T7 cfu/g dry soil X 10^4). Initial increase in microbial population may be due to stage specific root exudation, chemical stimulation and high availability of nutrient which are highly influenced by the addition of external supply of nutrients in different treatments. At 60 days after sowing (DAS) the population declined in all the treatments (2.6 in T9 to 6.5 cfu/g dry soil X 10^4 in T7). Similar trend was also recorded in population of beneficial fungi (*Trichoderma* spp, *Aspergillus* spp and *Penicillium* spp) (Fig. 1-4). Among all the treatments, T6 and T7 were better in growth and population buildup of different mycoflora including beneficial ones. Availably of essential soil nutrients like carbon, nitrogen, phosphorus and potassium are high at early growth stage and gradually decline with the crop age (Asghar *et al.* 2013). The result signifies that integration of recommended dose of fertilizer with 10t FYM ha-1 (T7) significantly improve the beneficial rhizosphere microbial population which plays important role in bio-control. The results are in conformity with findings of many workers (Deshpande and Murumkar, 2008, Majumdar *et al*. 2014).

It can be concluded that of nutrient (both organic as well as inorganic) greatly influences the

Table 1. Mean total as well as beneficial fungal population (cfu/g dry soil X10[4]) in jute rhizosphere at different crop stages

Treatment	Total count ($10^{4)}$			*Aspergillus* sp.			*Penicillium* sp.			*Trichoderma*sp.		
	Initial	30DAS	60DAS	Initial	30DAS	60DAS	Initial	30DAS	60DAS	Initial	30DAS	60DAS
T1	1.55	6.7	5.2	0.42	3.80	5.0	0.20	1.50	0.230	0.26	3.40	2.80
T2	1.50	7.4	6.4	0.08	2.30	2.70	0.55	3.20	3.2 0	0.25	3.60	4.20
T3	1.28	7.5	6.3	0.05	2.50	2.10	0.20	4.20	1.20	0.29	3.01	1.22
T4	0.95	7.6	5.7	0.08	2.50	2.0	0.12	4.90	3.70	0.40	3.70	4.60
T5	1.75	3.3	6.5	0.37	0.60	1.8	0.20	1.20	0.90	0.58	1.40	1.02
T6	1.12	8.1	5.9	0.40	3.20	3.20	0.07	0.70	0.25	0.23	0.92	0.40
T7	1.42	9.4	6.5	0.10	3.70	0.6	0.12	4.20	2.30	1. 80	5.80	4.90
T8	2.35	7.4	5.2	0.20	1.62	1.21	0.20	2.60	2.02	0.40	3.40	1.83
T9	1.45	3.1	2.6	0.08	.09	0.07	0.13	0.15	0.15	0.20	0.17	0.19
Mean	1.48	6.72	5.59	0.19	2.25	2.75	0.19	2.516	1.50	0.35	2.82	2.35
CD (P=0.05)	0.12	0.75	0.49	0.01	0.20	0.19	0.01	0.21	0.09	0.03	0.23	0.21

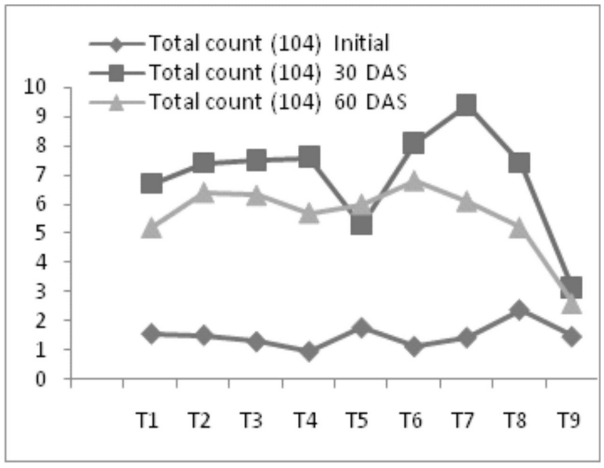

Fig 1. Population of rhizosphere mycoflora at different growth stage of jute

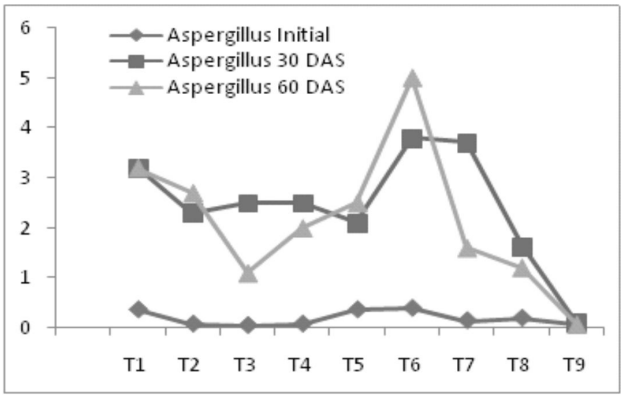

Fig 2. Population of *Aspergillus*spp at different growth stage of jute crop

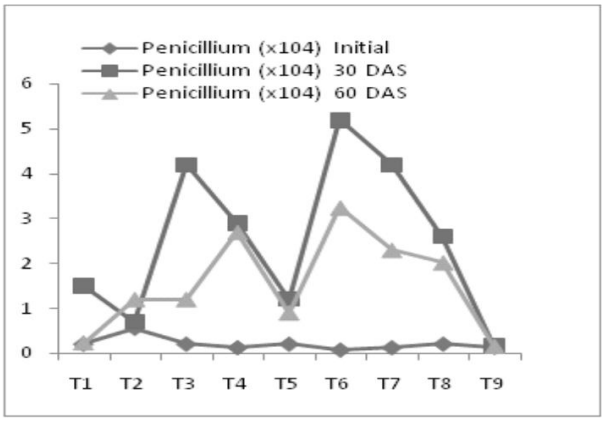

Fig 3. Population of rhizosphere *Trichoderma*spp at different growth stage of jute crop

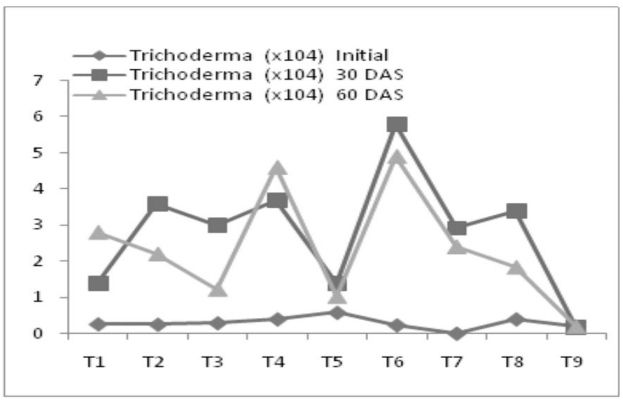

Fig 4. Population of rhizosphere *Penicillium*spp at different growth stage of jute crop

rhizosphere microbial population. The growth stage of the crop also influences the rhizosphere microbial population. This is due to root exudates (source of nutrients) as well as chemical stimulation. Among different nutrient treatments addition of 100% NPK+10t FYM greatly influence the microbial population over other inorganic nutrients and cultivated fallow. The result signifies that addition of nutrient specially organic manure significantly increase the beneficial microbial population which plays a significant role in biological control of soil-borne pathogens operated in the soil. It also signifies that food base is essential for function of bio-control agents.

REFERENCES

Ahmed Mushtaq and Upadhyay, R.S. 2009. Rhizosphere fungi of tomato: their effect on seed germination, seedling growth and the causal agent of wilt of tamato. *Journal of Mycopathological Research*, **47**:99-110.

Asghar, I., M. Akmal, M. Ishtiaq, M. Maqbool and T. Hussain. 2013. Analysis of soil microbial biomass dynamics in rainfet wheat fields in ard zone of Pakisthan. *Pak. J. Bot*., **45**:389-399.

Majumdar,B. Saha, A.R., Ghorai, A.K. Sarkar. S.K., Chowdhury, H., Kundu, D.K. And Mahapatra, B.S. 2014. Effect of fertilizer treatments on jute (Chorchorus olitorius), microbial dynamics in its rhizosphere and residual fertility status of soil. *Indian Journal of Agricultural Sciences* **84** : 503–08

Deshpande, A.N and Murumkar, D.R. 2008. Effect of tillage practice and nutrient source on microorganism counts in the rhizosphere of winter sorghum (Sorghum bicolor). *Indian Journal of Agricultural Sciences* **78** : 470-72

Oyeyiola, G.P. 2009.Rhizosphere mycoflora of okra (Hibiscus esculentus*). Res. J Soil Biol*. **11:** 31-36