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BIOTECHNOLOGICAL APPROACH OF CYANOBACTERIAL BIOMASS FOR BETTER YIELD OF PADDY

(*Oryza sativa* cv. Sonam)

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ABSTRACT

The effect of cyanobacterial biofertilizer, with or without chemical fertilizer was studied on the grain yield of *Oryza sativa* (cv. Sonam). The chemical fertilizer was added in the respective field as N.P.K. (120:60:60) and Zinc-Sulphate @ 20 kg.ha^{-1}. The field treated with combination of cyanobacterial inoculants and chemical fertilizer showed highest grain yield (39.60±5.20 q.ha^{-1}) against control field (22.60±1.1909 q.ha^{-1}). The field treated either cyanobacterial inoculants or chemical fertilizer have also recorded high grain yield when compared and found statistically superior. It is evident from result that the application of cyanobacterial inoculants with fertilizers has definite beneficial effects for paddy yield.

Keywords: Cyanobacterial biofertilizer, chemical fertilizer, noculants

Cyanobacteria are photosynthetic prokaryoates, the only group of algae fixing nitrogen, which derive electrons from water for the reduction of CO_2 and evolve oxygen. The role of cyanobacteria in increasing the crop yield has been convincingly demonstrated by many workers (Singh 1961, Venkatraman 1981, Kannaiyan 1985, 1990, Ahluwalia *et al*., 1985, Tiwari *et al*., 1991, Tiwari 2002). In submerged rice field soils, biological nitrogen fixation is essentially an algal process contributing about 30 kg N/ha. Using 15_N values a range of 40-80 kg N/ha/yr have been recorded by Watnabe *et al*., (1977). Nitrogen-fixing cyanobacteria are capable to increase the paddy yield approximately 10-20% by adding 20-30 kg N/ha/season in rice field (Kannaiyan 1996), Kannaiyan *et al*., 1981). Rodger and Kulasooriya (1980). Venkataraman (1981) Vaishampayan *et al*. (2001) have comprehensively reviewed the ecophysiological and technological aspect of cyanobacteria with special reference to paddy field ecosystem. In the present study attempt has been made to find out the effect of cyanobacterial inoculation to paddy grain yield and the results are presented herein.

EXPERIMENTAL METHODS

Nursary of *Oryza sativa* (cv. Sonam) was raised during the second week of June. The seedlings were uprooted from nursery and 1-2 healthy seedlings were transplanted at distance of 20 cm from line to line and is 15cm from plant to plant. The plots were separated into four units by earthen bunds. The treatments included in this study were: (1) control niether cyanobacteria nor chemical fertilizers added into the field (ii) only cyanobacterial inoculants. (iii) only chemical fertilizers N.P.K. (120:60:60) kg.ha^{-1}+$ZnSO_4$ (20kg.ha^{-1}). (iv) cyanobacterial inoculants with chemical fertilizers. In all the treatment P and K were applied basally as superphosphate and murate of potash while N was applied as urea in split doses. Remaining half of the N-fertilizers @ 30 kg.ha^{-1} (as urea) was applied into two equal doses. First half dose of fertilizer was applied at tillering stage after 30 days of transplantation while remaining half dose was applied during penicle initiation (approx. 75 days of plantation).

Soil based cyanobacterial culture was obtained from Biocontrol Lab, IPM Building Collectorate Farm Chandpur crossing, Varanasi. The composite culture of cyanobacteria consisted of *Nostoc, Anabaena, Aulsoira, Aphanotheca* and *Gloeocopsa* and applied @ 12.5 kg.ha^{-1} in the irrigated field after 10 days of transplantation and field was kept water logged for 4-5 days

Experiments were conducted in randomized block design with three replicates. The experimental variable consisted of 4 treatments with paddy crop *Oryza sativa* (cv. Sonam).

RESULTS AND DISCUSSION

The results on grain yield of paddy is presented in Table-1 with and without combination

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of cyanobacteria inoculants and chemical fertilizers. The grain yield was increased to 76.66% in the field treated with cyanobacteria culture and chemical fertilizers (39.60±5.20 q.ha^{-1}) against control field (22.00±1.90 q.ha^{-1}) while the grain yield in the field treated with cyanobacterial and chemical fertilizers separately was 26.50±5.50 q.ha^{-1} and 35.25±3.15 q.ha^{-1} respectively. Thus, over all in padely grain yield was increased 39.56%. ANOVA among the treatment (F = 1456.65, df = 3) was found significant at 1% level.

Table-1
Effects of cyanobacterial biofertilizer on the yield of Oryza sativa cv. Sonam (Values are average of three replicate with ±S.D.

Field treatment	Grain yield q.ha^{-1}	ANOVA
Control	22.00±1.90	
Control+Cyano. inoculant	26.50±5.50	
Control+Chem. Fertilizer	35.25±3.15	F = 1456.65
Control+Chem.Fertilizer+Cyanobacteria inoculant	39.60±5.20	

The results obtained from the treatment of paddy field with and without cyanobacteria and chemical fertilizers revealed that the highest grain yield was recorded due to application of cyanobacterial culture with chemical fertilizer while other treatment have also recorded higher grain yield when compared with control (Table-1). It is evident from the result that the application of cyanobacterial inoculants with chemical fertilizers have definite beneficial effects for paddy yield. The data of grain yield revealed that the cyanobacterial bio-fertilizer alone or along with chemical fertilizers was more than control (Table-1). The improved crop yield might be due to enhancing the N-status of the soil along with carbon and available phosphorous as well as marked improvement in soil aggregation and hydraulic conductivity as reported earlier by Kaushik and Jain (1985) and Kaushik (1995). It has been shown that fixed nitrogen from cyanobacteria is directly transferred to paddy plants (Watnabe *et al*., 1977). Chemical fertilizers along with cyanobacterial culture supported highest grain yield without influencing the cyanobacterial growth. Ammonium equivalent to 100 kg.N-ha^{-1} had no adverse effect on the recovery of cyanobacterial nitrogen (Venkataraman 1981, Ladha *et al*., 1987). Thus, it is concluded that the treatment of paddy field along with cyanobacterial inoculants and chemical fertilizers is the best treatment for more production of grain yield of paddy.

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