J. Phytol. Res. 2 (1), 1989

EFFECT OF SINGLE AND DUAL SYMBIOSIS ON GROWTH, PERCENT MYCORRHIZAL INFECTION AND RHIZOSPHENE BACTERIAL POPULATION IN *PENNISETUM AMERICANUM* AND *SORGHUM VULGARE*

V.M. RAO, BANWARI LAL , JAYSHREE and H.S. NARAYANA
Department of Botany, University of Rajasthan, Jaipur–302 004, India.

The seedlings of *Pennisetum americanum* and *Sorghum vulgare* were inoculated by *Azospirillum lipoferum*, an endophytic nitrogen fixing becterium, and *Gigaspora calospora*, an endomycorrhiza, separatly and together to see the effect of single and dual symbiosis on growth, chlorophyll a and b contents, percent mycorrhizal infection of host roots and rhizosphere bacterial (*Azospirillum* and general bacteria) population of the test plants. The highest values of the parameters of growth, chlorophyll content and percent root infection were observed in seedlings inoculated by both the symbionts. The rhizosphere bacterial population both of *Azosprillum* and general bacteria was more in seedlings inoculated by *Azospirillum* than those inoculated only by endomycorrhiza. The dual symbiosis had the synergistic effect on growth by both the symbionts causing the highest benefit to the test millets.

Keywords : *Azospirillum lipoferum; Gigaspora calospora; Pennisetum americanum; Sorghum vulgare*; Rhizosphere, Dual symbiosis.

Generally symbiosis even with one microorganism is beneficial to the gross performace of the plant (Mosse and Hayman, 1971; Cohen *et al.*, 1980). However, in nature the plants may be associated with more than one symbiont. The effect of this dual or multiple symbiosis is known to benefit largely the host plant (Crush, 1974). A dual symbiosis is prevalent in many non-leguminous crop plants (cereals and millets) (Subba Rao *et al.*, 1985a, 1985b; Singh, 1987; Singh and Subba Rao, 1987). In the present communication the effect of *Azospirillum* (a semisymbiotic bacterium) and endomycorrhiza on growth, percent mycorrhizal infection and rhizosphere bacterial population (*Azospirillum* and general bacteria) in *Pennisetum americanum* (Pearlmillet) and *Sorghum vulgare* (Sorghum) is presented.

The surface sterilized seeds of *P. americanum* and *S. vulgare* were

Table 1. Effect of single and dual symbiosis on growth, rhizosphere bacterial population and percent mycorrhizal infection of roots in 45 days old seedlings of *Sorghum vulgare* and *Pennisetum americanum*.

Treatment	Host	Dry Wt. (g)	Chlorophyll content (mg/g fresh weight)		Rhizosphere bacterial Population		% infection of roots
			Chl.a	Chl.b	General Bacteria	*Azospirillum*	
Control	Sv	27.00	0.3375	0.2809	3.93×10^4	2.0×10^4	41
	Pa	45.00	1.6606	0.2118	3.56×10^4	1.10×10^4	41
Azospirillum	Sv	275.00	0 4143	0.3512	5.50×10^4	5.50×10^4	51
	Pa	77.00	2.0976	0.2840	4.08×10^4	4.16×10^4	48
Mycorrhiza (*G. calospora*)	Sv	276.50	0.4975	0.4195	4.48×10^4	4.10×10^4	63
	Pa	81.50	4.0511	0.6262	3.32×10^4	2.03×10^4	67
Azospi. + Mycorrhiza	Sv	298.50	0.6124	0.4754	5.97×10^4	5.30×10^4	80
	Pa	83.50	4.7062	0.7497	5.68×10^4	5.48×10^4	80

Sv = *Sorghum vulgare*
Pa = *Pennisetum americanum*

germinated on 1.0% agar. The healthy germinated seedlings were transplanted to 20 earthen pots with three seedlings each in four lots. The seedlings of first lot of five pots were treated with 50 μl of 1 0 OD of *A. lipoferum* a nitrogen fixing endophytic bacterium) containing 1.2X10^8 cells in the rhizosphere of seedlings. The seedlings of second lot of five pots were transplanted over a pad of mycorrhizal inoculum of *G. calospora* alone. The seedlings of the third lot of five potswere transplanted over the pad of mycrrohizal inoculum and were also inoculated by 50 μl of *A. lipoferum* (1.0 OD) in the rhizosphere. The seedlings of the fourth lot of five pots were left as control without the addition of any inoculum The plants were harvested after 45 days and the readings on various parameters, such as growth by dry weight, content of chlorophyll a and b (Parsons and Strickland, 1963) percent of mycorrhizal infection of host roots and population of *Azospilum* and general bacteria in the rhizosphere of host plant, were taken.

In the present investigation, the dual inoculation of *Pennisetum americanum* and *Sorghum vulgare* with *A. lipoferum* and *G. calospora* increased the growth by dry wt., chlorophyll content (Chl.a + Chl.b), rhizosphere bacterial population and percent VAM root infection. The values of above parameters were less in single inoculations with *A. lipoferum* and *G. calospora*, respectively, and least in control (Table 1). The stimulatory effect of *A. lipoferum* and *G. calospora* could be explained on the basis that *Azospirillum* is now known to produce several growth promoting substances (Tien *et al.*, 1979) and enhance the root biomass of the plant (Dewan and Subba Rao, 1979) besides N_2 fixation (Mosse, 1973; Manjunath and Bagyaraj, 1981; Krishna *et al.*, 1982). The endomycorrhiza is known to be involved in better phosphorus nutrition of the host by mobilizing available phosphates. The effectiveness of VAM mycorrhiza in increasing the plant growth was enhanced in the presence of *Azospirillum* inoculation (Subba Rao *et al.*, 1985a; 1985b). Further, the dual symbiosis had the synergistic effect on growth by both the symbionts and caused highest benefit to the test plants.

Accepted March, 1989.

References

Cohen E, Okon Y, Kigle J, Nur I and Henis Y 1980, *Plant Pysiol* **66** 746

Crush J R 1974, *New Phytol.* **73** 743

Dewan G I and Subba Rao N S 1979, *Plant Soil* **53** 295

Krishna K R, Bagyaraj D J and Rai P V 1982, *Indian J. Microbiol.* **22** 206

Manjunath A and Bagyaraj D J 1981, *Plant Soil* **13** 295

Moose B 1973, *Ann. Rev. Phytopathol.* **11** 171

Mosse B and Hayman D S 1971, *New Phytol.* **70** 29

Parsons and Strickland J D H 1963, *J. Marine Res.* **21** 155

Singh C S 1987, *Proc. Nat. Workshop on Mycorrhizae* p 322

Singh C S and Subba Rao N S 1987, *Proc. Nat. Workshop on Mycorrhizae* p 335

Subba Rao N S, Tilak K V B R and Singh C S 1985a, *Soil Biol. Biochem.* **17** 119

Subba Rao N S, Tilak K V B R and Singh C S 1985b, *Plant Soil* **84** 283

Tien T M, Gaskin M H and Hubbell D H 1979, *Appl. Environ. Microbiol.* **37** 1016