

Inoculation and fertilizer blending affects nodulation of climbing bean and soybean in Kenya

An assessment of legume root nodulation by two grain legumes in response to inoculation and fertilizer source suggests that nodulation number, frequency of crown nodulation and the effectiveness of symbiosis may be controlled by crop management. Two grain legumes, climbing bean “Kenya Tamu” and soybean SB19 were established at twelve locations in west Kenya. Seed of both crops were planted with and without BIOFIX rhizobial inoculant (CIAT 899 for bean and USDA 110 for soybean) after application of single super phosphate (SSP) fertilizer in a 2 x 2 design. In an additional fifth management, Sympal was substituted for SSP and inoculated soybeans planted. Sympal contains not only phosphorus, calcium and sulfate (as does SSP) but also potassium and magnesium. Plants were carefully uprooted six to eight weeks after emergence, soil removed by gentle shaking and inspected for root nodulation using a 0 to 5 scoring system where 0 = no nodules, 1 = 1 to 5 nodules (rare), 2 = 6 to 10 nodules (few), 3 = 10 to 20 nodules (moderate), 4 = 20 to 50 nodules (abundant) and 5 = >50 nodules (extra abundant). Nodule distribution was also scored as crown (many at upper tap root) or diffuse. Two nodules per plant were cut open and nodule contents described as red (including pink) or other (white, green or grey). Trials were installed, managed and data recorded by farmers receiving training from the N2Africa Project. One trial at Bara in Kisumu experienced crop failure but results from the other eleven trials were entered into a spreadsheet data base and summary statistics calculated. Inoculation did not greatly affect nodulation of bean, but more than doubled the proportion of nodules with red interiors, presumably effective nodules (Table 1). Inoculation of soybean increased nodule scores, crown root nodulation and the proportion of effective nodules. Further modest increases were observed in soybean when Sympal fertilizer was substituted for SSP (Table 1). These results suggest that nodulation may be managed through inoculation and fertilizers but that these effects may be subtle, as when the proportion of effective vs non-fixing nodules increases. These results also indicate that farmers attending two day training in BNF technologies are well positioned to conduct simple diagnostic on-farm experiments. Yield measurements are being performed from these trials and will be reported at a later date.

Table 1. Nodulation characteristics within different on-farm BNF technologies in west Kenya during the 2011 long rains.

legume ¹	inoculant ²	fertilizer ³	sites	nodulation score ⁴	crown nodulation	nodules w/ red interior
			n	(0-5 ± SEM)	----- frequency (%) -----	
bean	none	SSP	11	2.58 ± 0.12	29	22
bean	CIAT 899	SSP	11	3.13 ± 0.09	29	45
soyabean	none	SSP	11	1.08 ± 0.08	7	45
soyabean	USDA 110	SSP	11	2.27 ± 0.09	37	62
soyabean	USDA 110	PKS+	10	2.45 ± 0.13	45	71

¹ climbing bean “Kenya Tamu” or soybean SB19. ² Commercially available BIOFIX inoculant for bean and soybean. ³ SSP = single super phosphate and PKS+ = MEA Sympal blend, both at 100 kg per ha. ⁴ Based upon observation of 40 plants per site, 430 plants total.

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