

mixed cropping of chickpea and mustard for heavy soil of Tal land in Bihar for achieving maximum land-use efficiency.

Maintenance of Seed Purity in Nonnodulating Lines of Chickpea

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During the course of our experimentation over the last 5 years with nonnodulating (Nod⁻) lines of chickpea, we noticed occasional presence of nodulated (Nod⁺) plants in the plots of Nod⁻ genotypes. In a low-N soil (<15 mg available-N kg⁻¹ soil in top 60-cm profile), such plants were readily noticed due to their better growth. Generally 1% or less plants were found to be Nod⁺ in the plots of Nod⁻ lines, which is unlikely to be due to genetic reversion of the trait. In an independent study, we noticed this level of contamination of desi-type seeds in the routine handling of a Nod⁻ kabuli line. This observation alerted us to the possibility of an increase in the proportion of Nod⁺ contaminants because of their better growth, in Nod⁻ populations, if care is not taken to rogue out these plants. The following two methods have been employed by us to keep the Nod⁻ lines free of contaminants.

1. On fields with low available-N. When Nod⁻ lines were grown on low-N soils (but not limiting in other nutrients), the plants grew very poorly and any plant growing well was found to be Nod⁺. Such plants could be easily rogued out.

2. On fields with moderate to high available-N. Nod⁻ plants cannot be easily differentiated from Nod⁺ plants when grown on fields with >20 mg available-N kg⁻¹ soil in the top 60-cm profile. To identify Nod⁻ plants in such fields, the plants were carefully removed from the soil at physiological maturity and their roots observed for nodulation. Seeds of the Nod⁻ plants were retained for further use.

Rouging is a must for the crop grown for seed multiplication for the next year. For any genetic study on non-nodulation, the plants used for crossing must be examined for nodulation at physiological maturity (Rupela, in press). Alternatively, selfed seeds of the plants used in the crosses may be separately harvested and tested for nodulation. We have supplied seeds of Nod⁻ lines to sev-

eral researchers and recommend that they critically examine this material before further use as there could be obvious implications for genetic studies.

These suggestions do not imply that all Nod⁺ plants in the Nod⁻ population are contaminants. At present we do not know the reason(s) for the Nod⁻ trait in our material. One possible reason could be the absence of a specific *Rhizobium* strain required by these lines. If so, most plants of a given Nod⁻ line should nodulate where adequate population of such a strain is present. We would appreciate receiving nodules and seeds of these plants from such locations. Nodules can be dried on calcium chloride vials as described by Somasegaran and Hoben (1985, P. 272) that can be mailed along with seeds of the same Nod⁺ plant(s) to establish whether the Nod⁻ line(s) required a specific *Rhizobium* strain.

References

Rupela, O.P. (In press). Natural occurrence of non-nodulating plants in chickpea and their salient characters. Crop Science (submitted).

Somasegaran, P., and Hoben, H.J. 1985. Methods in Legume – *Rhizobium* technology. NifTAL project and MIRCEN, University of Hawaii, Hawaii, USA. 367 pp.

A Method for Application of Chickpea Rhizobia over Large Areas

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Chickpea germplasm evaluations at ICRISAT Center during the 1987/88 postrainy season were planned for a Vertisol field (BS 10) where chickpea had not been grown for at least 17 years. Most probable number estimation (Toomsan et al. 1984) of chickpea rhizobia in the field prior to sowing of chickpea revealed very low *Rhizobium* numbers (<10 rhizobial cells g⁻¹ of soil). Responses of chickpea to *Rhizobium* inoculation are to be expected when counts are <100 cells g⁻¹ soil (Rupela and Saxena 1987). Several methods of *Rhizobium* application are recommended for chickpea, such as the liquid suspension method where peat inoculum suspended in water is applied on seeds at sowing time (Islam and Afandi 1980; Rupela et al. 1984), but they are not easy to apply over large areas. We therefore adopted the following procedure: