Abstract

The main objectives of this study were; (1) To find out whether farmers in Makueni District were aware of soil fertility status in their farms and annual food availability, (2) To find out the proportions of cultivated areas under grain legume production and the problems faced by farmers in grain legume production, (3) To screen and select high yielding cowpea varieties for dryland Makueni District, (4) To determine the effects of integrated soil fertility management (ISFM) on nodulation, growth and grain yield of selected cowpea varieties, and (5) To determine the effects of ISFM on nitrogen fixation, indigenous soil rhizobia populations and rhizobia diversity. Farmer participatory meetings were used to establish whether farmers recognized soil fertility as a problem in legume production. Results obtained revealed that farmers in the selected sites recognized soil fertility as a problem and included it in the list of general problems affecting them. Participating farmers indicated that only 2% of the cultivated farms in the study sites had fertile soils. To document grain yields, area under legume cultivation and problems faced by farmers in grain legume production, a structured questionnaire was used to collect information from farmers. Results obtained showed that grain yields ranged from 30 kg/ha to 416 kg/ha and area under legume cultivation from 48% to 92%. Problems faced by farmers in legume production included low soil fertility, inadequate farm inputs, weeds, pests and diseases. To select pioneer cowpea varieties, 34 cowpea varieties were selected and screened for two seasons at Kiboko Dryland Research Station. Some of the cowpea parameters assessed included pod length, plant biomass, grain yield and weights of 100 seeds. From the screening studies, nine cowpea varieties were selected for on-farm trials. To determine the effects of integrated soil fertility management (ISFM) on nodulation, growth and grain yield of selected cowpea varieties, on-farm trials were established at two sites. The nine cowpea varieties that had been selected during the screening studies were planted in the trials. Treatments applied included a control, farmyard manure at 2.5 t/ha, phosphorus as triple superphosphate (TSP) (P205, 0:46:0) at 15 kg/ha and a combination of both manure and TSP at the singly applied rates. Data collected included nodule and shoot biomass, and grain yields. Results obtained revealed that treatment application enhanced nodule and shoot biomass, and grain yields. Nitrogen fixation was estimated using 15N natural abundance method while rhizobia populations were determined using most probable number (MPN) experiment. Rhizobia diversity was determined using culture characterization and direct PCRRFLP of the 16S-23S rRNA intergenic spacer region

(IGR) of rhizobia genome. Results of nitrogen fixation showed that 46-53% nitrogen (N) was fixed at a wetter site, while no N fixation took place at a drier site. Results from rhizobia population assessment revealed population counts of 4.89x102 to 2.0x104 cells/gram of soil with lower rhizobia counts at planting relative to the harvesting time while high rhizobia counts were recorded in amended soils relative to the controls. Further, restriction of eighteen rhizobia isolates from cowpea nodules with MspI restriction endonuclease revealed four rhizobia IGS groups