ABSTRACT

SELECTING SOYBEAN FOR IMPROVED BIOLOGICAL NITROGEN-FIXATION POTENTIAL

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The study on selecting soybean for improved biological nitrogen-fixation had four objectives: (1) to collect and propagate soybean germplasm; (2) to select soybean cultivars with highly nitrogen-fixation potential; (3) to evaluate techniques on nitrogen- fixation measurement, and, (4) to propagate the highly nitrogen-fixing ability of soybean cultivars for future research. This study was conducted at the Department of Agronomy, Maejo University.

Experiment 1, Rainy season, 1997: 57 soybean cultivars were selected for high nitrogen-fixing ability under rhizobium-inoculated condition. The results revealed that some soybean cultivars which showed good performance and high nitrogen fixing ability, consisted of CM60, SJ4, SJ5, MSS#11, ST1, ST2, KUSL20004, Deepamauad, Leichhardt, Dokkaowmalatdee, Fukuyutaka and CM2. These selected soybeans produced yields in the range of 230 to 250 kg/rai. Black seed soybeans which also showed good performance and high nitrogen-fixing ability were 911CPI17977, 1394 K.S.B. 1396 I.G.BB, DIXIE 64009, PI210123, 1579 I.G.BB and CM 8737-B-6. Result of ARA measurement on nitrogen activity revealed an average of 7.03 μmole C_2H_4/g.nodule dry weight/hour and seed yield production was at a range of 222 to 227 kg/rai.

Experiment 2 Dry season, 1997: 31 soybean cultivars that included hybrid cultivars (F_1 generation) and 11 parent cultivars were selected for a high potential of nitrogen-fixing ability, seed yield and yield components. The results showed that

hybrid soybean cultivars of 9610, 9605, 9614 and 9618, produced high seed yield in the range of 302 to 308 kg/rai and produced 98.72 root nodules per sample (n=3), an average of 0.359 grams of dry weight per sample, acetylene reduction activity (ARA) of 30.20 μmoleC_2H_4/g.nodule dry weight/hour, nitrogen percentage of 4.226% and total nitrogen average of 630 milligram per sample, which were all higher than the parents.

Experiment 3. Rainy season, 1998: 31 soybean cultivars which included 20 hybrids (F_4 generation) and 11 parent cultivars were evaluated for high nitrogen-fixing ability and yield components. The results showed that hybrid soybean cultivars of 9610, 9605, 9614 and 9618 produced high seed yield in the range of 300 to 304 kg/rai and gave 30-40 pods per plant, 47.79 root nodules per sample, 0.32 grams/nodule dry weight, acetylene reduction activity (ARA) of 14.21 μmole C_2H_4/g.nodule dry weight/hour, 3.035% of nitrogen and a total of 588.439 milligram N per sample.These averages were higher than the parents.

The results of combined analysis during different seasons revealed a highly significant relationship and correlation between yield, yield components and nitrogen-fixing ability. The hybrid soybean cultivars of 9610, 9605, 9614 and 9618 showed high yield and high nitrogen-fixing performances during every season. A positive correlation between also existed among the number of branches per plant, number of pods per plant, number of seeds per pod, 100-seed weight and yield. There was also a positive correlation between plant dry weight, ARA, %N and total N.