MODULE 4: DEMONSTRATION 2

ESTIMATING NITROGEN INPUTS OF A SOYBEAN CROP

PURPOSE:

Demonstrate that nitrogen inputs (from soil and BNF) for a legume crop can be reasonable estimates from available data or information.

Demonstrate that the high protein (and therefore nitrogen) content of legumes requires higher amounts of N from BNF with increasing yields.

CONCEPTS OF DEMONSTRATION

This exercise demonstrates the utility of using some simple calculations to estimate N inputs of a soybean crop. Participants predict N needs based on available information, including what they know from a non-legume grown in their area. The important concept that N may be supplied from soil and from BNF is reinforced.

CONDUCTING THE DEMONSTRATION

This exercise can be divided in two parts; part one asks participants to estimate the rate of nitrogen supply from the soil needed to obtain an average (yield and % N) soybean crop, and part two asks them to estimate the increasing amounts of N required from BNF to obtain increased soybean yields.

Part one

According to Agricultural Statistics 1985 (U'.S.D.A., U.S. Gov't Printing Office, Wash., D.C.) the average yield of maize in Indonesia was 1800 kg/ha. With a normal protein content of 9.5%, and therefore a nitrogen content of 1.52% (%N = Protein/6.25), the participants can calculate the N yield and the daily N supply rate from the soil.

Assuming that like most soils N is the most limiting nutrient, and other factors are not yield limiting, consider the introduction of a soybean crop. If an average yield (1000 kg/ha) and 6.08% nitrogen content (based on 38% protein in seed) is expected what will be the N yield, and the N supply rate from the soil required to meet the soybean crop N requirement?

The following table should be constructed:

Crop	Estimated Yield	Nitrogen Content	Nitrogen Yield	Crop Duration	Nitrogen supply rate required
	kg/ha	%	kg/ha	days	kg/ha/day
Maize	1800	1.52	27	120	0.23
Soybean	1000	6.08	61	95	0.64

Shaded figures to be calculated, others given.

Two important and related questions arise here: 1) Do the participants think their soils can meet the higher N supply rate required for this soybean crop?, and 2) if not, what lower yield would be expected for soybean?

Part Two

From Part 1, it is shown that a 1000 kg/ha soybean crop has a N yield of 61 kg/ha. Let us assume that the 27 kg of N/ha found in the maize crop is the nitrogen supplying capacity of an average Indonesian soil. The participants can then calculate the amount of N that must be supplied from BNF to make up the difference. The percent N from BNF can then be calculated. Once this is done, new estimates of N yield, amount and percent N from BNF, can be calculated for hypothetical higher yields.

The following table should be constructed:

Estimated Soybean Yield	Nitrogen Yield	Nitrogen from soil	Nitrogen from BNF	%N from BNF
kg/ha	kg/ha	kg/ha	kg/ha	%
1000	61	27	34	55
1500	91	27	64	70
2000	122	27	95	78

Discussion on the implications of this data is encouraged. It can be seen that the average soybean yield (1000 kg/ha) will require about 55% of its N from BNF.

Higher yields will require higher levels and percentage of N from BNF.

This exercise can be conducted in teams or with the whole group. In either case, a master table for parts 1 and 2 can be constructed on a chalkboard, and the calculated figures filled by consensus.

WORKSHEET

ESTIMATING NITROGEN INPUTS OF A SOYBEAN CROP

1. The average 1985 yield of maize in Indonesia was 1800 kglha. The normal protein content is 9.5%. Since protein is 6.25% nitrogen, the nitrogen content of the harvested maize is 1.52% (9.5 divided by 6.25). With this information you can calculate the nitrogen yield and an average nitrogen supply rate from an unfertilized soil. Fill in these two figures for maize in the table below.

Crop	Estimated Yield	Nitrogen Content	Nitrogen Yield	Crop Duration	Nitrogen Supply Rate
	kg/ha	%	kg/ha	days	kg/ha/day
Maize	1800	1.52	-	120	-
Soybean	1000	6.08	-	95	-

Now consider a soybean crop that will be growing under the same conditions. The anticipated yield is 1000 kg/ha. With a typical protein content of 38%, this is a nitrogen content of 6.08%. As with the maize, calculate the nitrogen yield and the required N supply rate from the soil (assuming that all the N came from the soil). Fill in these figures in the table.

Despite yielding lower than maize, the N yield for soybean is much higher. Why is this? Do you think most soils on which maize is grown could increase their N supply rate to meet the demand in the soybean?

2. Let us assume that the N yield of the maize (part 1) represents the N supplying limit of a given soil. Assuming further that the typical N content of soybean seed is 6.08% (part 1) it is obvious that BNF must supply some of the crop's N. For the typical 1000 kg/ha yield of soybean, how much N in this case will have to be supplied from BNF? What percent of the total N is this? Using the same assumptions, calculate the N yield, N from BNF, and % N from BNF for cases where higher yield, 1500 and 2000 kg/ha, were obtained. Complete the following table.

Estimated Soybean Yield	Nitrogen Yield	Nitrogen from soil	Nitrogen from BNF	%N from BNF
kg/ha	kg/ha	kg/ha	kg/ha	%
1000	-	27	-	-
1500	-	27	-	-
2000	-	27	-	-

Discuss the implications of these figures with your colleagues and instructors.