

## Extension programs to promote rhizobial inoculants for soybean and groundnut in Thailand

C. CHANASENI AND S. KONGNGOEN

Department of Agricultural Extension, Chatuchak, Bangkok, Thailand, 10900

Received September 9, 1991

Revision received December 18, 1991

Accepted January 2, 1992

CHANASENI, C., and KONGNGOEN, S. 1992. Extension programs to promote rhizobial inoculants for soybean and groundnut in Thailand. *Can. J. Microbiol.* **38**: 594-597.

The promotion of rhizobial inoculants for soybean (*Glycine max*) and groundnut (*Arachis hypogaea*) in Thailand has been conducted by the Thai Department of Agricultural Extension (DOAE). The inoculant is produced by the Thai Department of Agriculture (DOA), which has a production capacity of 200 metric tons per year. The DOAE has emphasized inoculant use since 1982 through the Soybean Marketing and Production Development Project and the Groundnut Extension and Development Project. These projects are aimed at increasing the average yield and total production of the legumes, especially soybean. Both projects have been promoted through training, on-farm activities, local mobile units, and field day activities. There has been approximately a 35-fold increase in yearly legume inoculant use between 1977 and 1990. In 1990, the DOA produced a total of 126.35 metric tons of inoculants for soybean, groundnut, mung bean, and other minor legumes. Of this total, 117.67 metric tons were sold. This figure represents in 200-g bag quantities (i) 477 333 bags of soybean inoculant; (ii) 72 746 bags groundnut inoculant; (iii) 35 461 bags mung-bean inoculant; and (iv) 2 810 bags inoculant for minor legumes. In addition, the private sector under the Soybean Joint Venture Project has produced and distributed approximately 100 000 bags inoculant (also 200 g each) per year in 1989 and 1990.

**Key words:** rhizobial inoculants, Thai Agricultural Extension, agricultural extension, legume inoculation.

CHANASENI, C., et KONGNGOEN, S. 1992. Extension programs to promote rhizobial inoculants for soybean and groundnut in Thailand. *Can. J. Microbiol.* **38** : 594-597.

La promotion des inoculants rhizobiens pour le soya (*Glycine max*) et l'arachide (*Arachis hypogaea*) a été conduite par le Thai Department of Agricultural Extension (DOAE). Les inoculants ont été produits par le Thai Department of Agriculture (DOA), dont la capacité de production a été de 200 tonnes métriques par année. Depuis 1982, le DOAE a fait la promotion de l'emploi des inoculants via le Projet de développement de la production et de la mise en marché du soya ainsi que le Projet de développement et d'accroissement de la production de l'arachide. Ces projets ont visé à accroître le rendement moyen de la production totale des légumineuses, plus spécialement celle du soya. Les deux projets se sont appuyés sur la formation, les activités à la ferme, les unités mobiles locales et les activités journalières au champ. L'emploi d'inoculants pour les légumineuses s'est accru d'environ 35 fois par année, entre 1977 et 1990. En 1990, le DOA a produit un total de 126,35 tonnes métriques d'inoculants pour le soya, l'arachide, la fève Mungo et d'autres légumineuses de moindre importance. De ce total, 117,67 tonnes métriques ont été vendues. Ce chiffre représente en termes de sacs d'inoculants de 200 grammes : 477 333 sacs pour le soya, 72 746 sacs pour l'arachide, 35 461 sacs pour la fève Mungo, et 2 810 sacs pour les autres légumineuses. De plus, le secteur privé, sous le couvert du Projet conjoint du soya, a produit et distribué environ 100 000 sacs par année d'inoculants de 200 g chacun, en 1989 et 1990.

**Mots clés :** inoculants rhizobiens, extension agricole Thai, extension de l'agriculture, inoculation des légumineuses.

[Traduit par la rédaction]

### Introduction

Soybean (*Glycine max*) and groundnut (*Arachis hypogaea*) are both produced in Thailand for domestic consumption. Soybean production is especially important to supply animal feed and vegetable oil extraction industries. In the crop year 1980-1981, domestic soybean production was about 100 000 metric tons. Although production has increased, it still does not meet current demands of 800 000 metric tons per year. Since 1983 the government has encouraged farmers to grow soybeans and has instituted a national policy to limit soybean importation. As a result, domestic production of soybean increased to approximately 670 000 metric tons in crop year 1989-1990 (Fig. 1). In the 1990-1991 crop year, however, production decreased to approximately 580 000 metric tons as a result of changes in government policy to permit free-market importation of soybean. There was a general trend of increased average yields for soybeans in the whole country from 950 kg ha<sup>-1</sup> in the 1980-1981 season to 1338 kg ha<sup>-1</sup> in the 1989-1990 season. Groundnut production is shown in Fig. 2. Average

groundnut yields fluctuated between approximately 1200 and 1400 kg ha<sup>-1</sup> during the same period. Projections by the Office of Agricultural Economics for the 1990-1991 crop season were approximately 1100 and 1300 kg ha<sup>-1</sup> for soybean and groundnut, respectively (Fig. 3).

Rhizobial legume inoculant has great potential to increase legume crop yields with lower costs of production than using nitrogen fertilizer. Because biological nitrogen fixation can contribute 14-224 kg N·ha<sup>-1</sup>·year<sup>-1</sup> (Bezdicsek and Kennedy 1988), rhizobial inoculation is considered an appropriate technology to be recommended to the farmers. The Ministry of Agriculture and Cooperatives through the Department of Agriculture (DOA) and the Department of Agricultural Extension (DOAE) are responsible for introducing inoculation technology to farmers. The cooperation between DOA and DOAE is structured so that the DOA is responsible for inoculant production and multidisciplinary research, while the DOAE is responsible for the distribution and promotion of the inoculant through training and other activities.

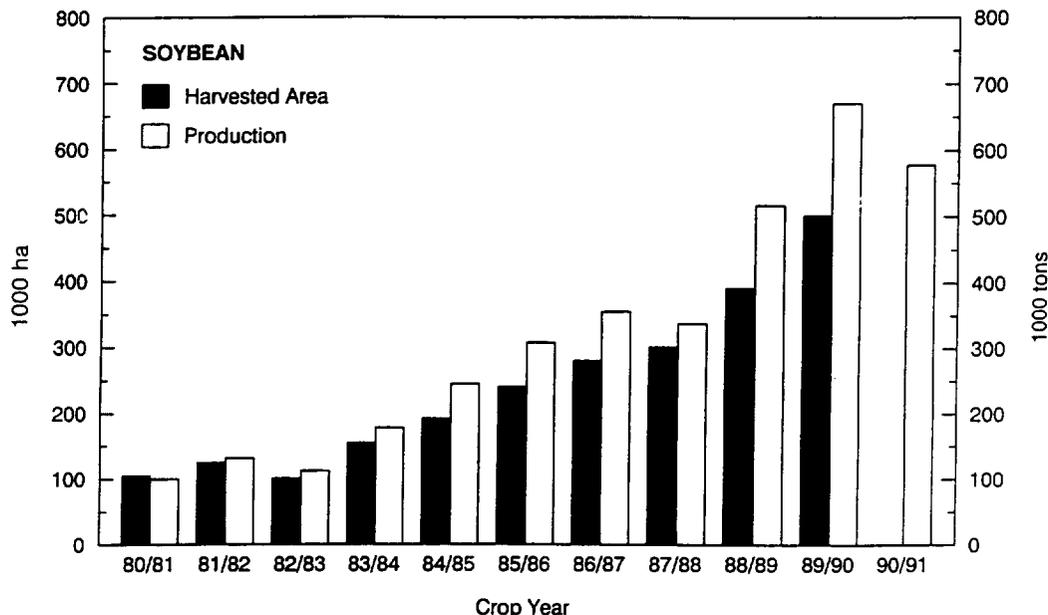


FIG. 1. Harvested area and production of soybean in Thailand for crop years 1980–1981 to 1990–1991 (Office of Agricultural Economics). Note that the 1990–1991 production figure is as forecast by the Office of Agricultural Economics.

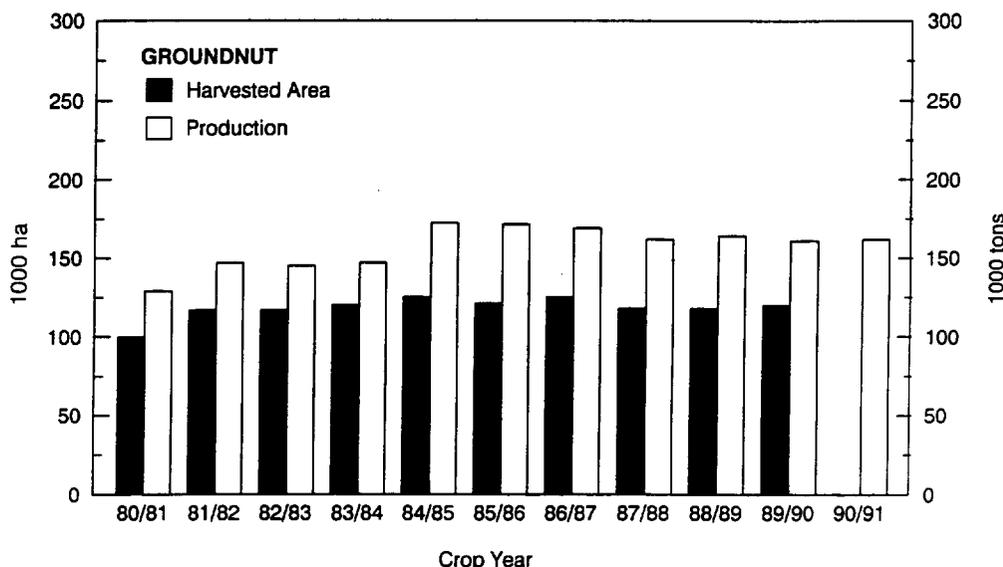


FIG. 2. Harvested area and production of groundnut in Thailand for crop years 1980–1981 to 1990–1991 (Office of Agricultural Economics). Note that the 1990–1991 production figure is as forecast by the Office of Agricultural Economics.

**Objectives**

The objectives of the DOA and DOAE programs are (i) increased production efficiency and yield of both soybean and groundnut through the use of suitable varieties of seed and of rhizobial inoculants and (ii) transfer of rhizobial inoculant technology through project planning and training of extension specialists. This training develops a thorough understanding of the technology and enables the extension specialists to promote inoculant use to farmers.

**Work plans**

The DOAE has conducted extension efforts to foster rhizobial inoculant use for soybean and groundnut in Thailand. First, training is the primary component of the

extension program. We need qualified staff with a thorough knowledge of inoculants in order to increase their credibility to the users. Second, farm trial activities are established in specific localities to provide information to extension specialists and farmers on the effects of the inoculants. Third, field days are organized after on-farm trial activities to demonstrate their profitable results. Finally, we develop cooperation with private sectors, especially with local dealers close to cultivated areas. These dealers supply a variety of agricultural materials such as fertilizer, seed, and pesticides, and they also extend credit to farmers. Local dealers can play a major role in distributing inoculants to remote farmers who may need to purchase only small quantities. These concepts are integrated in the organization of the following projects.

2

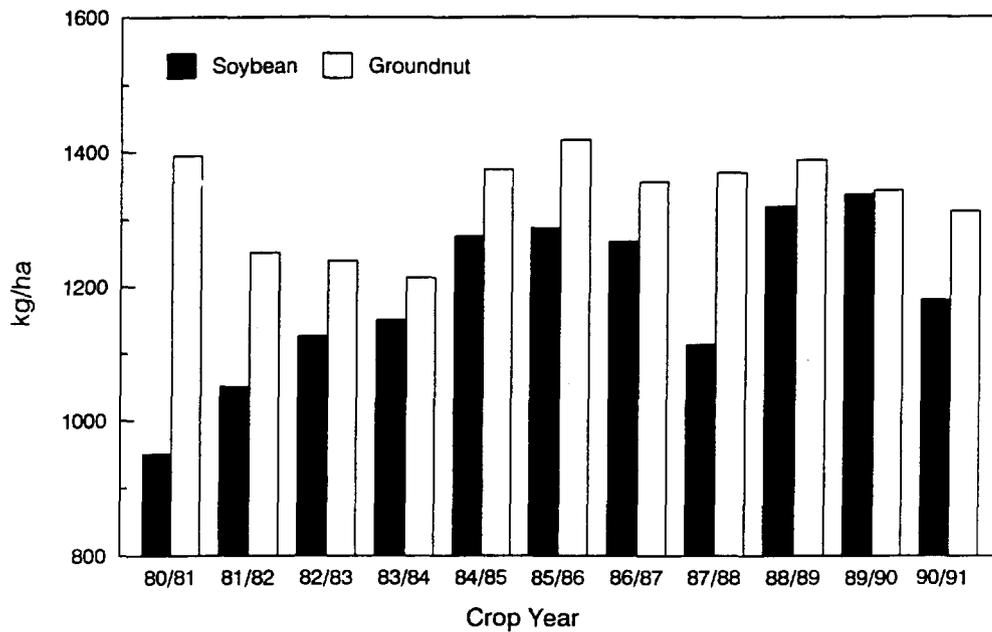


FIG. 3. Soybean and groundnut yield in Thailand for crop years 1980–1981 to 1990–1991 (Office of Agricultural Economics). Note that the 1990–1991 production figure is as forecast by the Office of Agricultural Economics.

TABLE 1. *Rhizobium* production by the Thai Department of Agriculture (DOA), and distribution through three sectors: Thai Department of Agriculture Extension (DOAE); private sector (PS); and Marketing of Farmer Organization (MFO), 1977–1990

Year	Inoculant		No. of bags* of inoculant distributed			Total quantities of inoculant distributed	
	Metric tons produced	Metric tons used	DOAE	PS	MFO	No. of bags	Value \$U.S.
1977	5.00	3.36	6 950	—	9 865	16 815	6 726
1978	10.59	11.55	17 430	—	40 323	57 753	23 101
1979	7.42	5.77	22 296	—	6 548	28 844	11 538
1980	4.92	5.64	16 761	—	11 429	28 190	11 276
1981	7.48	7.36	26 649	—	10 164	36 813	14 725
1982	6.58	6.64	20 877	8 584	3 763	33 224	13 290
1983	14.36	13.15	34 557	30 079	1 104	65 740	26 296
1984	36.16	33.79	112 073	56 885	—	168 958	67 583
1985	48.77	46.51	157 323	75 264	—	232 587	93 035
1986	78.00	74.78	285 796	88 115	—	373 911	149 564
1987	81.63	79.79	248 595	150 378	—	398 973	159 564
1988	140.70	136.23	593 941	90 237	—	684 178	273 671
1989	134.27	125.3	557 527	68 996	—	626 523	250 609
1990	126.35	117.67	557 772	30 578	—	588 350	235 340

\*One bag contains 200 g inoculant at a cost of 10 baht (\$U.S. 0.40).

#### Seed Exchange Program

This 5-year program was conducted from 1982 to 1986. This program focused on soybean expansion and improvement of production efficiency. Participating farmers were allowed to exchange their local variety seed for selected varieties produced by government seed centers at a 1:1 ratio. Participation was conditioned on farmers also buying a 200-g bag of inoculant for every 10 kg of exchanged seed. The cost of one bag of inoculants is 10 baht or \$0.40 U.S. The recommended inoculant rate is six bags of inoculant per hectare and a planting rate of 62.5 kg soybean seed per hectare.

#### Soybean Marketing and Production Development Project

This 5-year project has been in effect since 1987. While this project's goals are the same as for the Seed Exchange

Program, the implementation is slightly different. Farmers may purchase a kilogram of superior variety seed for 10 baht instead of the normal price of 15 baht, provided they also purchase a bag of inoculant at the normal price of 10 baht.

The government provides a budget to implement the inoculant promotion activities, such as the reduced-cost seed, mobile units which visit farmers' fields, and mass media advertising. The mobile unit attracts local farmers with training activities, slide presentations, on-farm demonstration field days, and inoculant sales.

#### Groundnut Extension and Development Project

The Groundnut Extension and Development Project has been in effect since 1987. This project focuses on improving production efficiency and product quality. Its work plan, activities, and project implementation are similar to those

of the Soybean Marketing and Production Development Project. Farmers can buy seed for 10 baht/kg and receive a free bag of inoculant with every 20 kg of seed purchased. Groundnut production is less than for soybean, and this program offers the free inoculant to motivate farmers to adopt the practice of inoculant use. Six bags of inoculant are recommended for the 125 kg of seed used to plant 1 ha.

#### *Soybean Joint Venture Project*

The Soybean Joint Venture Project was conducted between 1989 and 1990. Under this project, the private sector also produced inoculants, and distributed approximately 100 000 bags per year. The data in Table 1 represent only inoculants produced by the DOA and do not include the production by private enterprise under the Soybean Joint Venture Project.

Under this project, farmers purchase agricultural material such as seed, fertilizer, rhizobial inoculants, and pesticides from certain contracted vendors within the private sector. The Bank of Agriculture and Agricultural Cooperatives (BAAC) provides loans to farmers for these purchases. The DOAE's responsibility is to educate farmers, and to cooperate with the farmers and the private sector. A major component of the project is an agreement that contracted private-sector dealers will purchase farmer's products at a guaranteed minimum price for farmers to receive a reasonable income and to ensure a stable market.

#### **Results**

The quantities of inoculant sold fluctuated between 1977 and 1981. Since 1982 the DOAE has cooperated with DOA to promote and distribute the inoculants through the projects mentioned above. Following DOAE involvement, there have been dramatic increases in the amount of soybean and groundnut inoculant sold, from 6.64 metric tons in 1982 to 117.67 metric tons in 1990, worth \$235 340 U.S. (Table 1). In 1990, farmers in Thailand used quantities of inoculant (each bag weighing 200 g) produced by the DOA as follows: 477 333 bags soybean inoculant (95.466 metric tons) and 72 746 bags groundnut inoculant (14.549 metric tons). They also used 35 461 bags mung-bean inoculant and 2 810 bags of inoculant for other minor legumes. In addition, the private sector under the Soybean Joint Venture Project has produced and distributed approximately 100 000 bags inoculant (200 g each) per year in 1989 and 1990.

The extent of inoculant use by farmers in Thailand was monitored from crop years 1986–1987 to 1989–1990 by the DOAE. Their evaluation showed that the percentage of crops receiving rhizobial inoculants increased from 30.3 to

TABLE 2. Monitoring and evaluation report (MER) on use of rhizobial inoculants (Department of Agricultural Extension 1990)

Crop	% crops inoculated with rhizobia			
	1986–1987	1987–1988	1988–1989	1989–1990
Soybean	30.3	44.8	52.4	50.9
Groundnut	9.8	12.3	17.4	22.0

50.9 and from 9.8 to 22% for soybean and groundnut, respectively (Table 2).

#### **Conclusion**

The use of rhizobial inoculants in Thailand has increased since the DOAE has started soybean and groundnut extension projects. These projects have promoted inoculant use through training activities, on-farm trials, field days, and cooperative agreements with the private sector. Although these extension projects have resulted in dramatic increases in inoculant use, total inoculant use is still low when the entire country is considered. The major problem of inoculant distribution is the high transportation cost, since many of the farmers are located far from the producer. This problem may be overcome if local dealers supply the remote farmers with inoculants. Our next step will therefore be to train local dealers and to develop their awareness of the importance of rhizobial inoculants to agriculture.

#### **Acknowledgements**

The authors gratefully acknowledge Dr. Nantakorn Boonkerd of the Thai Department of Agriculture for providing inoculant production data, and Barbara Sedano-Parrish, Patty Nakao, and Paul Singleton of the University of Hawaii NifTAL Project (DAN-4177-A-00-6035-00) for manuscript preparation and review and publication support. ✓

- Bezdicsek, D.F., and Kennedy, A.C. 1988. Symbiotic nitrogen fixation and cycling in terrestrial environments. *In* Micro-organisms in action: concepts and applications in microbial ecology. Edited by J.M. Lynch and J.E. Hobbie. Blackwell Scientific Publications, Oxford. pp. 241–260.
- Department of Agricultural Extension. 1990. Monitoring and evaluation reports. Planning Division, Bangkok, Thailand.
- Office of Agricultural Economics. 1990. Statistics of crop annual. Ministry of Agriculture and Cooperatives, Bangkok, Thailand.