

## **Seed Production and Research in India**

P. K. Agrawal

Head, Division of Seed Science & Technology  
&

Project Coordinator, National Seeds Programme  
Indian Agricultural Research Institute, New Delhi

**India**

Advances in plant breeding have led to the development of high yielding varieties of different crops. When a plant breeder develops a superior variety it is important that its seed be multiplied and made available to the farmers in time. Evolution of improved varieties is meaningless unless the seed of the improved varieties is increased in a scientific and systematic way and is made available to the farming community.

Food production has been increasing in India and cereals particularly wheat has contributed significantly in it. For example, the area under wheat crop over the last 15 years (from 1965 to 1980) has increased to about 177 % but increase in production during the same period was about 337 %, a remarkable increase indeed. The compound rate of growth for wheat during the pre-technology period (upto 1963-64) was 3.95 which increased to 7.36 during the post technology period (1967-1970) which was highest among all agricultural crops which shows the contribution of technology **including quality seed** in increasing wheat production.

Until fifties, seed for propagation was largely a by-product of crop producer for food, feed or fibre. With the advancement in agricultural technology, it was realized to develop seed production as a primary enterprise instead of a by-product as it has been handled down through centuries.

Paper presented in the Seminar on "Seeds" organised by the National Institute of Agronomic Research and National Society of Commercial Seeds under Ministry of Agriculture and Land Reforms from April 23-26, 1985 at Rabat, Morocco.

Abbreviations used : I.A.R.I. (Indian Agricultural Research Institute) I.C.A.R. (Indian Council of Agricultural Research) ; I.S.S.T. (Indian Society of Seed Technology) ; N.C.A. (National Commission on Agriculture) N.S.C. (National Seeds Corporation) ; N.S.P. (National Seeds Programme) ; S.F.C.I. (State Farms Corporation of India) : S.T.R. (Seed Technology Research).

The first analysis of seed production needs and problem in India was made by the Royal Commission on Agriculture, the report of which was published in 1928. In 1957, the Indian Council of Agricultural Research (ICAR) in collaboration with the Rockefeller Foundation started the All India Coordinated Maize Improvement Project. And in 1961, four hybrids of maize were released. The complexity of the seed production processes needed for these hybrids led to the realisation that the existing seed pro-

(TDC). The TDC was established in 1969, with the World Bank assistance, centering around the Goving Ballabh Pant University of Agriculture and Technology, Pantnagar (U.P.) India, associating progressive farmers of the area and the NSC. The project aimed at the development of 16.000 ha for seed production including 5.000 ha of the university farm. This was the first attempt to develop a compact area for seed production which was further extended in the formulation of the National Seeds Programme (NSP) and establishment of State Seed Corporations.

During 1953-54 to 1984-85, the quantum of certified quality seeds distributed in the country increased by about four thousand times as will be evident from Table 1. The cropwise break up is given in Table 2. It is evident from Table 2 that bulk of the seeds distributed was of cereals and in cereals about 40-45 % was accounted by wheat alone (date not shown).

Table 1. The quantity of certified/quality seed distributed in India

Year	Quantity in million quintals
1953-54	0.183
1978/79	0.903
1979/80	1.400
1980/81	2.501
1981-82	2.980
1982-83	4.206
1983-84	5.703
1984-85	7.200

Table 2. Cropwise break-up of distribution of certified/quality seeds

	y e a r		
	1982-83	1983-84	1984-85
	(million quintals)		
Cereals	2.510	2.767	4.600
Pulses	0.235	0.205	0.600
Oilseeds	0.376	0.408	0.700
Fibre crops	0.206	0.190	0.300
Potato	0.879	2.126	1.000
Others	—	0.001	—
Total	4.206	5.703	7.200

### Variety Testing and Releases Mechanism

Varieties before release are tested for three years in an India Coordinated Research Project of a given crop. Based upon their performance it is identified for release for a specific agro-climatic region. After identification of varieties by the coordinated project it is tested at the Government farms for adaptation (adaptive trial). Simultaneously the seeds are produced by SFCI which are distributed in mini kits of 5 kg to farmers for knowing their preference over the existing varieties.

Once a variety has been identified in the coordinated project, the breeder seed production is also undertaken by the university/institute which has developed the variety. If a variety has been found to be superior in adaptation and mini-kit trial, the coordinated project proposes it for release. The proposal is then examined by the Central Subcommittee on crop standard, notification and release of varieties. If the variety is found to be of superior nature than the existing variety it is then recommended by the sub-committee to the Central Seed Committee for release and notification. The variety becomes eligible for certification only after notification.

### Stages of seed multiplication and organisation

Generation system of seed production has been developed and for highly self pollinated crops like wheat are as follows :

Breeder seed ————— Foundation seed stage I ————— Foundation seed stage II ————— Certified seed stage I ————— Certified seed stage II.

## **Organisation**

### **Production of breeder seed :**

Indent for the supply of breeder seed is received by the Seed Division of the Union Ministry of Agriculture which passes it to the I.C.A.R. The ICAR finally send the indent to the Agricultural Universities/Institutes for production and supply of the breeder seed of those varieties which have been developed by them.

There are 33 breeder seed production units located in Agricultural universities/institutes which have been established under the NSP (Fig. 1). the breeder seed production is undertaken by a qualified plant breeder and not by the crop breeder himself. Thus the crop breeder is able to devote his full time in breeding superior varieties. The producing breeder is assisted by a team of scientists from the disciplines of seed technology, plant pathology, entomology etc...

Breeder seed is not certified in India, however, the breeder seed production is monitored by a Joint inspection team constituted by the ICAR consisting of a plant breeder, a representative each of the Crop Coordinator seed certification and foundation seed agency to check the quality of seed during production. Hundred percent genetic purity is essential. Minimum standard for germination has not been fixed but it is desired to be at least of the same level as fixed for the foundation seed.

The breeder seed is supplied to Governmental Agencies including N.S.C., State Seed Corporations ; S.F.C.I. and reputed private seed companies for the production of foundation seed. There are 13 State Seed Corporations located in different states of India (Fig. 2).

### **Production of Foundation Seed :**

The agencies for the production of foundation seed are : Agricultural Universities ; N.S.C., State Farms Corporation of India (SFCI), State Seed Corporations and private seed companies. The production by NSC and State Seed Corporations is taken either at their own farms or through contract growers. Preference for foundation seed production is given to Agricultural Universities in view of their expertise and technical competence. Foundation seed is certified by the seed certification agencies located in different parts of the country which are 16 in number (Fig. 2).

### **Production of Certified Seed :**

Seed certification is a means to produce genetically pure good quality seed by means of field inspections and regulations for checking on the production, harvesting, cleaning and processing of each lot of seeds.

Certified seed production is done by N.S.C., S.F.C.I., State Seed Corporations and private seed companies. S.F.C.I. produce certified seed at their own farms whereas other agencies through contract growers.

### **Quality control**

Quality control in seed production is exercised through field inspection during seed crop growth and by analysis of seed for different quality attributes. Field inspections are done by the staff of seed certification agencies

and as stated above there are 16 seed certification agencies located in different parts of the country (Fig. 2). There are 1478 technical persons working in seed certification agencies and 2.78.915 ha were certified in 1983-84.

### **Seed Law enforcement**

The Indian seed Act was passed by the Parliament in 1966. The Seeds Act and the Rules stipulated that for notified varieties of crops, no person would sell or offer to sell or exhibit for sale, any seed not conforming to certain minimum standards of germination and purity laid down under the Act.

As for the Seeds Act certification is voluntary and truthful, labelling is compulsory. However, farmers have shown great faith in certified seed ; therefore, there is a great demand for certified seed.

### ***National Seeds Project***

The National Commission on agriculture (NCA) has envisaged that to cater for a cropped area of 200 M ha covering all kinds of food grain, forage, horticultural and plantation crops in the year 2000 A.D. we require 70 breeder seed organisations, a few foundation seed agencies at the national level, about 50 at state level, including official and private ones and 360 certified seed agencies, 3000 seed processing units and an equal number of seed stores.

To achieve the above projection partly, the financial assistance from the World Bank was obtained to start the National Seed Project (I & II) at a total cost of US \$ 87.6 million (US \$ 52.7 for NSP I and US \$ 34.9 M for NSP II) with about 50 % loan from the World Bank. The NSP has 3 components : (i) Breeder Seed Production (ii) Seed Technology Research and (iii) Training and technical assistance (Consultancy) in seed technology. The NSP-II would end by the end of December 1985 and the Government is planning to launch NSP-III.

The NSP have helped in organising 33 Breeder seed production units in agricultural universities and I.C.A.R. institutes, 24 Foundation Seed Production units in agricultural universities and state seed corporations and 14 seed technology research centres. All these units and centres have been equipped with modern equipment and facilities for the production, processing, storage and conducting research on various aspects of seed science and technology.

### **Education and Training in Seed Science and Technology**

Four agricultural universities in India are offering post-graduate degrees in Seed Science and Technology namely Indian Agricultural Research Institute, New Delhi ; Tamil Nadu Agricultural University, Coimbatore ; University of Agricultural Sciences, Bangalore ; and Mahatma Phule Agricultural University, Rahuri. 5-10 post graduate students get degree from each university each year. These universities also offer short term training courses. The National Seeds Corporation in collaboration with the Indian Agricultural Research Institute conducts training courses of various durations (2-12 weeks) on different aspects of seed technology. The Division of Seed Science and technology at Indian Agri-

cultural Research Institute also conducts training courses in seed testing and certification. 16 such training courses have been conducted in our division and 285 persons have been trained so far (Fig. 4). Three training courses ranging from 10-30 days have been planned in our division in 1985 and it is hoped to train 40 persons in 1985. Refresher courses are also conducted at Indian Agricultural Research Institute and the last one was conducted in April-May, 1984 on recent techniques in Seed Science and Technology. This course was meant for researchers working in agricultural universities/institutes to enhance their technical competence.

### **research in Seed Science and Technology**

Under the National Seed Project 14 Seed Technology Research (STR) centres have been established at different agricultural universities (Fig. 5). In addition, well established centres for seed research were functioning at Tamil Nady Agricultural University, Coimbatore Indian Agricultural Research Institute, New Delhi and Govind Ballaoh Pant University of Agriculture and Technology, Pantnagar, prior to the formation of NSP. An All India Coordinated Seed Technology research Programme under the NSP has been started and the first workshop was held in 1981 and the fourth workshop was held in september, 1984. In these workshops, results of the various experiments conducted at various centres are presented, discussed and future line of action is planned. Under coordinated Seed Technology Research (NSP) experiments on isolation distances, planting ratio, identification of suitable areas for seed storage, effects of packaging material on seed viability during storage, loss of seed viability during transit, biochemical basis for varietal identification, evolving procedure for seed testing for tropical seeds, the efficacy of fungicides for controlling seed borne diseases and efficacy of plant products for control of insect-pests during seed storage etc. are conducted.

### **Role of Private Seed Industry**

Private seed industry is playing an important role in the overall development of seed industry in India and in making available good quality seed to the farmers in time. Over the last 15 years private seed industry has enlarged considerably. It is estimated that about 500 seed companies are doing business. They are also exporting seeds and custom seed production are undertaken by them for export purposes. In addition, they are also involved in evolution of varieties and recently hybrids of pearl millet, maize, sunflower and cotton etc. have been released by some reputed companies which have been reported to perform very well at farmers field.

### **Indian Society of Seed Technology**

Hundreds of seed technologists are engaged in teaching, research, extension and seed production. To provide a forum to these people to share experience and grow professionally and to provide a link, the Indian Society of Seed Technology (ISST) was formed in 1971. The ISST has about 600 active members and publishes a quarterly semi-technical news bulletin (started in 1971) and a half yearly research journal called the Seed Research (started in 1973). These publications are an excellent means to spread the new developments in seed science and technology.

The Society has conducted six India Seed Seminars and the last one was conducted by the author in Nagpur from April 7-9, 1982 on post harvest technology of seeds. Earlier seminars were held on varietal identification including grow out test in 1980, seed certification in 1978, seed storage and processing in 1976. From 1980, the society has started giving annual award to the best research paper published in "Seed Research" in order to encourage publication of good research paper in the Journal. So far about 600 research papers have been published in Seed Research comprising 24 numbers in 12 volumes.

#### **Publication for Seed Certification Staff**

Various publications have been brought out either by the Indian Council of Agricultural Research or Government stating seed standards etc. for helping the field and laboratory staff in seed production, certification and quality control. Some of the important publications are : (1) Indian Minimum Seed Certification Standards (ii) Field Inspection Manual (iii) A Handbook for Seed Inspectors (iv) Seed Testing Manual.

In addition to the above, various seed certification agencies publish hand-outs for their staff to facilitate field inspection and certification work.

FIG. 1

NATIONAL SEED PROJECT  
( BSP - UNITS )

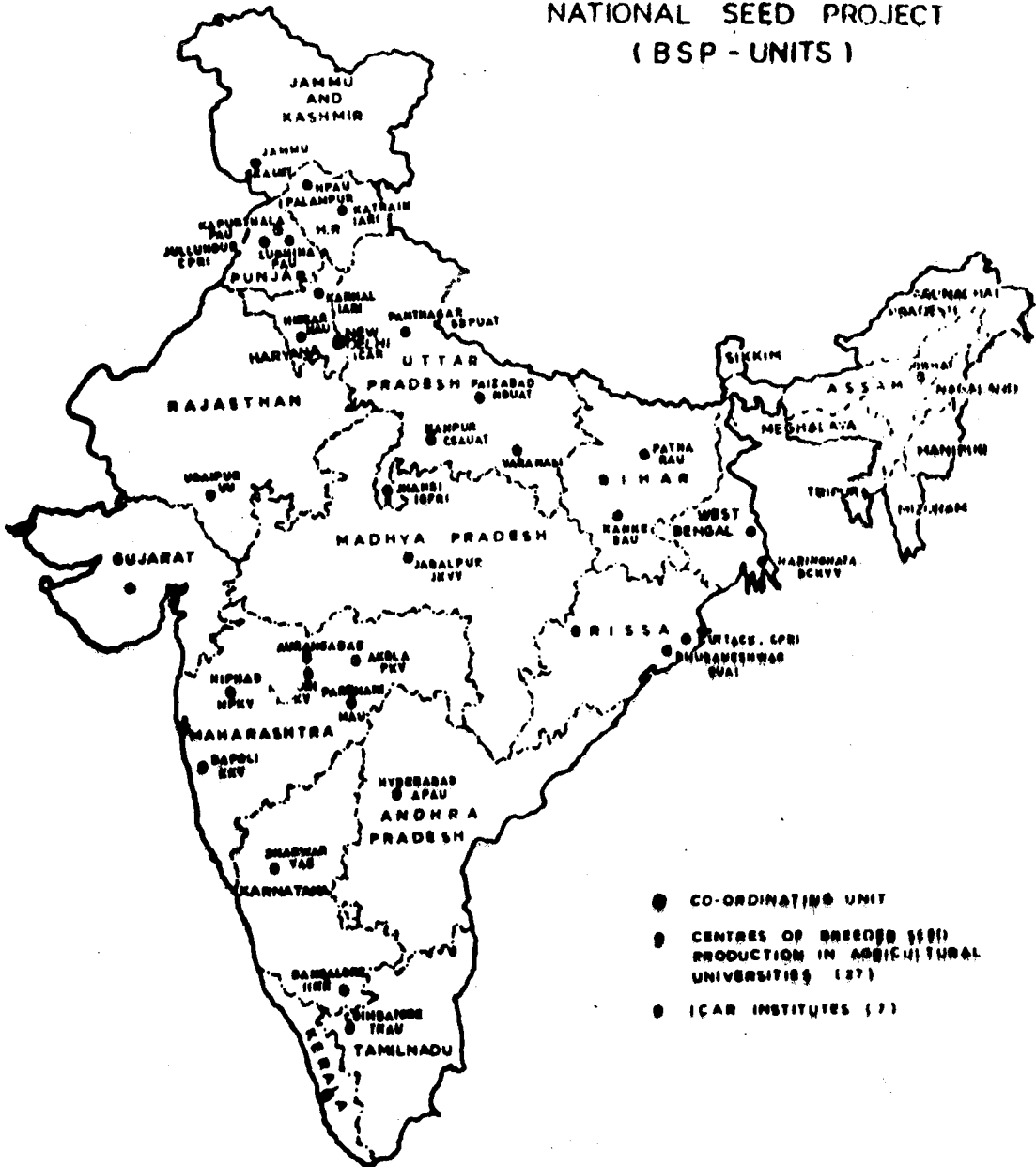




FIG. 2

### SEED CERTIFICATION AGENCIES AND STATE SEEDS CORPORATIONS IN INDIA

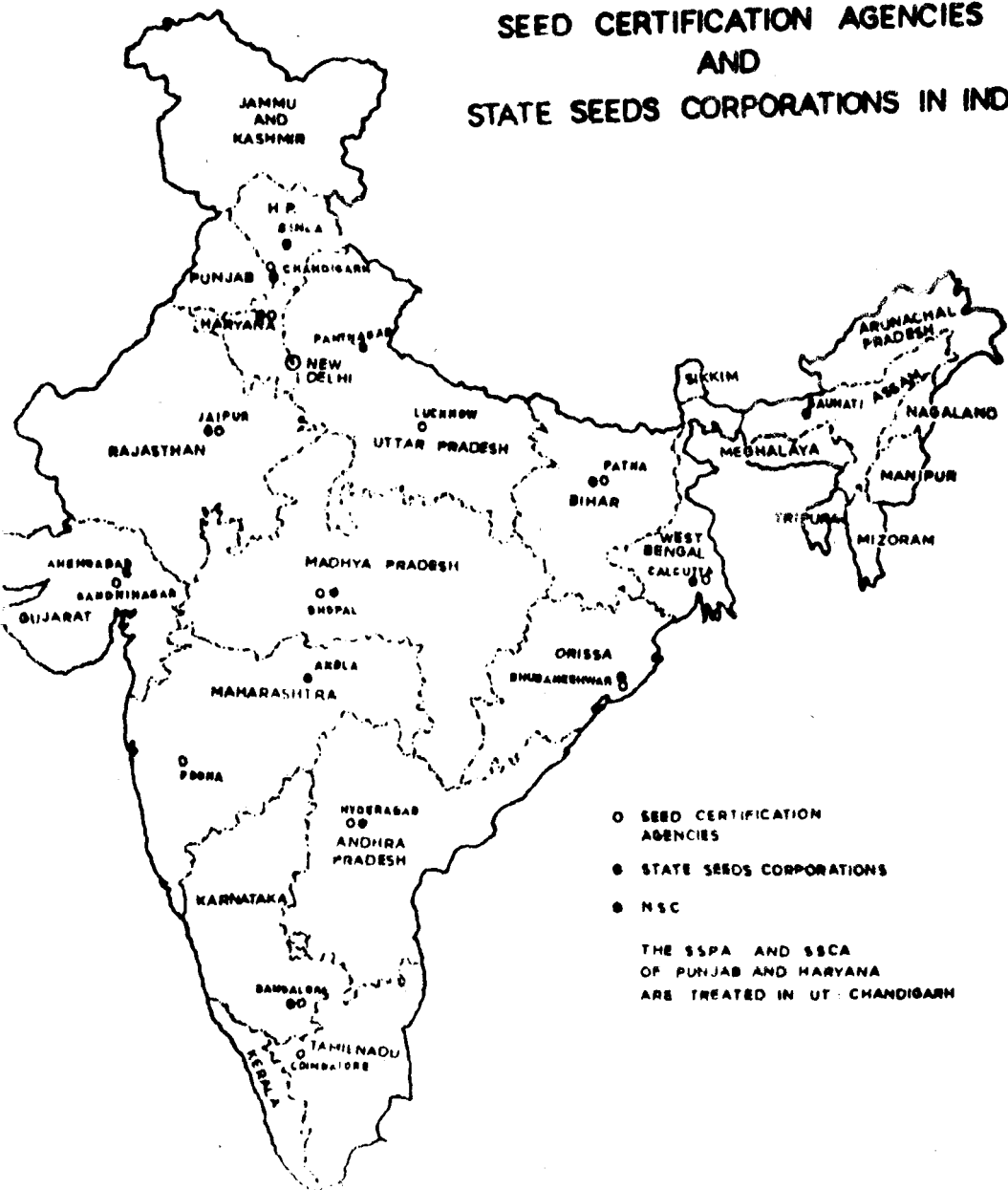
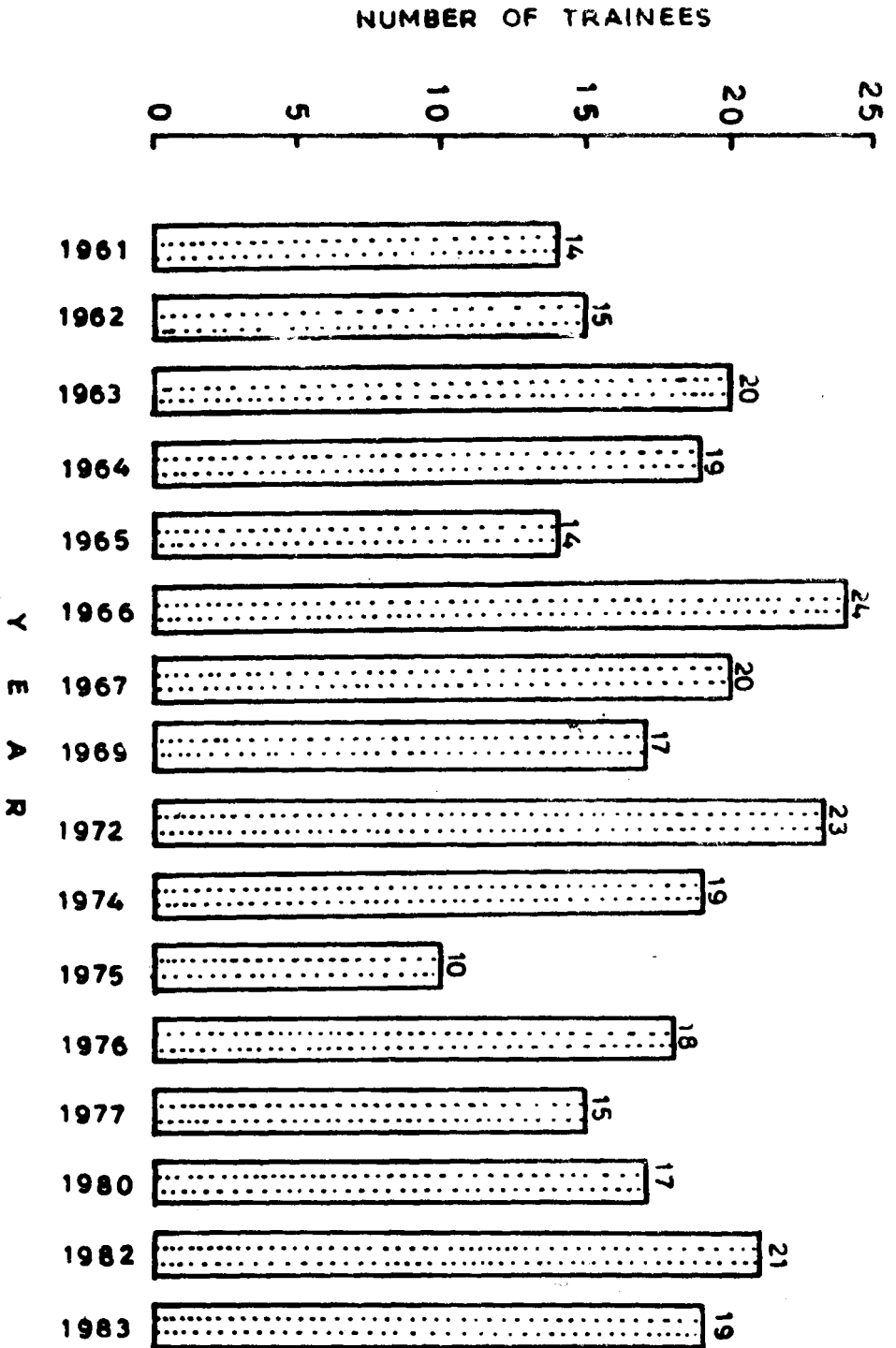


FIG. 3

SEED TESTING LABORATORIES  
IN INDIA





**FIG. 4 NUMBER OF PERSONS TRAINED IN THE ALL INDIA SEED TESTING COURSE CONDUCTED BY THE DIVISION OF SEED SCIENCE AND**

### Résumé de l'Organisation du Secteur de Semences à l'Inde

Dans cet exposé, l'état actuel de la sélection et la production de semences, la recherche et la formation de ce secteur a été décrit. Il suit l'évolution de la production de semences ; c'est à dire, la sélection — les semences de base — et les semences certifiées. Les commandes pour la livraison des semences de pré-base seront faites auprès de la Division de semences au Ministère de l'Agriculture de l'Inde et soumises au comité indien de la recherche agronomique. Compte tenu des besoins de la production de la semence de pré-base 33 unités sont effectués à la production de semences de pré-base. Les unités sont attachées aux différentes universités et instituts agricoles dans les différentes régions de l'Inde. Les semences de pré-base sont données à la société nationale de semences, des associations de fermes étatiques, des sociétés régionales de semences et de sociétés privées pour la production de semences de base. Les préférences pour la production de base sont données aux universités de l'agriculture vu leurs expériences et leurs capacités techniques. Les semences de base sont certifiées en Inde. La production de semences certifiées est faite par la société nationale de semences, des associations des fermes étatiques, les sociétés de semences régionales et des sociétés privées. L'association de fermes étatiques produit les semences certifiées dans leurs propres fermes et aussi avec les autres sociétés sous contrat avec les multiplicateurs. L'agrèage de semences certifiées dans leurs propres fermes et aussi avec les autres sociétés sous contrat avec les multiplicateurs. L'agrèage de semences est effectué par un agrèage aux champs et un agrèage au laboratoire. L'agrèage aux champs est effectué par le personnel de service de contrôle régional.

Il y a 16 services de contrôle régionaux avec 1478 contrôleurs. EN 1983/84, 287.915 ha sont agrées en parcelles. L'agrèage en laboratoire est effectué dans 55 laboratoires. L'analyse contient la faculté germinative, la pureté spécifique et le taux d'humidité. Suite aux résultats de l'agrèage aux champs et aux laboratoires, le service de contrôle régional a établi le certificat d'agrèage, blanc pour les semences de base, et bleu pour les semences certifiées. La législation en vigueur en Inde a été proposée et acceptée au Parlement en 1966. La législation règle les conditions minimums pour la vente certifiée. Un projet national de semences a été instauré avec un coût total de 87,6 Mio. de Dollars, financé à 50 % par un crédit de la Banque Mondiale. Le projet national de semences a aidé pour l'organisation de 33 unités par la production de pré-base, 24 unités de production de base, et 14 Centres de Recherches de la Technologie de semences. Tous ces centres-unités ont été équipés avec des matériaux modernes pour la production, le conditionnement, et le traitement et l'infrastructure de stockage. Ces équipements servent également pour la recherche des différents aspects de la science et de la technologie des semences.

4 universités de l'agriculture offrent des études pour des diplômes de spécialisation des postes universitaires dans la matière de la science et de la technologie de semences. Ces universités et la société nationale de semences offrent des stages à court terme de différentes durées pour les différents aspects de la technologie de semences. Les sociétés privées des semences jouent un rôle important dans le développement général du secteur de semences en Inde. On estime qu'à peu près 500 sociétés privées travaillent dans ce secteur. Tout récemment des améliorations ainsi que la sélection

des plants ont été réalisées exclusivement par les instituts étatiques, mais depuis peu certaines sociétés privées ont sélectionné des variétés hybrides dans des cultures de coton, du maïs et du sorghum.

Dr. Pramod K. AGRAWAL  
Head & Project Coordinator,  
National Seeds Programme  
Division of Seed Science and Technology  
Indian Agricultural Research Institute  
New Dehli — 11 00 12 (INDIA)