League of Arab States
Arab Organization
for Agriculutral Development

Improved Seed Production in the Arab World and Means of Its Development

by

Arab Organization for Agriculutral Development

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IMPROVED SEED PRODUCTION IN THE ARAB WORLD AND MEANS OF ITS DEVELOPMENT

I. INTRODUCTION :

Agricultural production represents an important section in the economic activities in the Arab World, where a great proportion of the citizen in the majority of the Arab countries depends mainly on agriculture as their main source of income. The economy of many countires in the region relies primairly on agriculture, while the remaining countries strive to reach self-sufficiency in food and achieve food security.

The use of quality seeds of improved varieties represents one of the main requirements for increased crop yield and reduction of production cost which represents an incentive to farmers by increasing their profit. It is believed that the use of quality seeds of improved varieties is responsible for at least 50% of the increase in the productivity of many crops. The lack of improved seeds is one of the main constraints affecting the full utilization of the improved varieties released by national and international research centres.

During the last decade, the number of countries which began to realize that improved seeds is one of the principal inputs for increased prodduct-ivity has greatly increased. This has led many countries to establish seeds production programmes to achieve self-sufficiency from improved seeds, since the dependency on imported seeds carries many risks, the least of these is the uncertainty of continued supply of seeds to farmers at the appropriate time.

One of the main objectives for the establishment of the Arab Organiz-ation for Agricultural Development (AOAD) is the development of agricultural and human resources in the Arab World. Realizing the great role of improved seeds in agricultural development and the lack of informat-ion on improved seed production in the Arab countries, AOAD has decided to participate with this paper, which discusses the status of seed production in the Arab World, constraints affecting the development of seed industry and the possibility of overcoming such constraints.

II. ESSENTIAL ELEMENTS FOR SEED PRODUCTION :

The availability of the basic requirements for agricultural production is a prerequisite for the development of any seed production programme. Generally, seed specialists have agreed that seed production areas should have high potential for agricultural production and should at least, meet the following requirements :-

(A) The environmental and climatic conditions should be suitable for seed production of the specific crop. In case of cereals and other grain crops, seeds can be produced in the same area of the commerc-ial crops. However for certain vegetables, the climatic conditions suitable for seed production differ greatly from those required for the production of the main crops. Generally, seed producers prefer areas with relatively dry summer to enable the seeds ripen and

the harvest operation to be completed with minimal deterioration . Also low relative humidity, with minimal rainfall and moderate temperature minimizes the development and dispersal of many diseases.

(B) Soil should be well drained, fertile and neither acidic nor alkaline, free from diseases and weed seeds, and the area should have a continuous supply of irrigation water to satisfy the crop water-requirements until harvest. It is preferable to produce seeds under irrigation rather than rainfall to ensure complete development and maturation of seeds.

(C) Availability of large area of land to allow for isolation of cross pollinated crops and permit the adoption of safe rotation to minimze the possibility of admixture and spread of diseases.

(D) The area should be free from the major pests that limit the productivity and quality of seed, also means for pest and disease control should be available.

1. Improved Varieties :

A sound seed programme requires the availability of imrpoved varieties, tested and released by the responsible agencies. The presence of plant breeding research represents the backbone of any seed programme. The main objective of plant breeding is the development of new varieties with superior traits compared to the available varieties, and to achieve this goal, breeders follow different breeding methods. The basic breeding methods can be summerized as follows :-

a. Introduction :-

This is the oldest method of breeding, and it was used by man unconsiously, where plant materials moved from one place to another according to man movement. The acquisition of superior varieties by importing them from other places accomplishes the same purpose as developing superior varieties in deliberate breeding programme. The introduced varieties can also be utilized in breeding programmes to transfer some of their characteristics to local varieties. Usually breeding programmes, their first phase, relies heavily on this method to benifit from existing germplasm.

b. Selection :-

Selection of desirable individual parents for the next generation is an ancient practice. One of the major attributes of this method is that it cannot create varability but acts only on that already in existence. So there is no advantage of using this method in the absence of variability. Some of widely used methods of selection are :-

(i) Mass selection:

This method can be used for the improvement of both self- and cross-pollinated crops . The general objective of it , is the improvement of

the overall characters of the variety by selecting the best plants that possess the superior and prefered characteristics of the variety and mixing their seeds after harvest to be used as seeds for the next generation. This method is widely used for the development of land varieties which constitute the basis of agriculture in the developing countries, and are likely to include lines that are too early or too late in maturity or disease susceptible, which can be excluded during the process of selection. It is a simple, rapid, safe and takes less time to develop new varieties or improve old ones.

(ii) Pure line Selection :

It is used for the improvement of self pollinated crops and involves three steps. In the first step, a large number of selection are made from the genetically variable population. These initial single plant selection is followed by growing progeny rows from the individual plant selection for observation for few years and the elimination of undesirable lines. The final step is the comparison of the remaining lines by replicated trials and the release of the best lines.

(c) Hybridization :

The objective of hybridization is to combine in a single genotype, desirable genes that are found in two or more different genotypes. The segregating generations after hybridization can be handled by one of many methods. The choice of the method, depends on consideration of many factors e.g. the yielding ability, adaptation, and disease reaction of the parents available . Generally, there are three basic methods for handling the segregating generation :-

1. Pedigree method.
2. Bulk method.
3. Backcross method.

(2) Variety Testing and Release :-

The presence of a proper system for variety evaluation and release is necessary for the success of seed programme. Variety testing and release in the developing countries is usually under the control of a government committee, where plant breeders submit their best lines, based on their own selection and evaluation to the committee. The varieties are usually evaluated in field tests for about three years in the various ecological zones of the country. In addition to yield and other characteristics, varieties should be evaluated for distinctness, uniformity and stability (DUS) to enable the controlling authority to regulate the release of the variety.

(3) Seed Multiplication :

The final goal of the seed programme is to secure enough supply of improved seed for farmers use. Following, variety release, the seed of that variety will be multiplied under strict regulation to maintain the

genetic purity of that variety. This process requires the follow-up of a well defined and highly technical system adopted by the seed industry world-wide to ensure the preservation of the genetic make-up of the variety, and involves the multiplication of seeds in the following four stages :-

(a) Breeder's seed :-

This is the seed which is carefully produced under the supervision of the variety's breeder or the research station which released it. It is usually maintained through high level of selection and should be 100% genetically pure. Breeder's seed is produced in relatively small quantities from plants which have been individually selected and seeded under strict condition. This class is sometimes known as nuclear seeds or pre-basic seeds.

(b) Basic or Foundation Seeds :

This is the progeny of breeder seeds and represents an important stage of seed multiplication, since it is the first multiplication of the breeder's seed. It is usually maintained by the institute responsible for seed multiplication on variety maintenance. It is the source of all other certified seed classes either directly or through registered seeds.

(c) Registered Seeds :

Registered seeds are the progeny of basic or foundation seeds. This class is an intermediate stage and can be omitted in some cases for some crops based on the available quantities of foundation seeds. Its production and handling must be approved and certified by the certifying agency. Registered seeds are used as source of certified seeds in some crops.

(d) Certified Seeds :

These are the first generation of multiplication from foundation seeds or registered seeds of a variety within a seed certification scheme. They are produced according to an officially approved and monitored programme. Certified seeds represent the last stage of seed certification and is distributed to farmers to produce the commercial crop, however, under certain conditions certified seeds can be planted to produce another generation of certified seeds.

4. Seed Processing and Treatments :-

The objective of seed processing is the removal of a wide range of materials including plant debris, non-plant materials e.g. soils or stones, seeds of other crops and weeds, damaged or discolored seeds and seeds which are outside the accepted size or density. It also aims at grading seeds and addition of chemicals for protection against pests and diseases. The separation of seeds from other materials is based on physical differences such as relative size, shape, length, density, surface texture, colour, affinity to liquids or relative conductivity. The range of processing operation can be divided into: (a) Pre-cleaning or scalping, which involves the separation of plant debris and other inert matter by vibrating or rotating sieves, (b) Basic cleaning,

during which all materials should be removed from the seed crop by sieves or air-screen machines and (c) Separation and upgrading process which improves the mechanical purity of the seedlot and may be done inorder to remove specific contaminants or appendages from the crop seeds. This process involves the utilization of spiral separator, disc and Cylinder separator, gravity separator or magnetic separator.

5. Storage :

The processed seeds should be stored under conditions which cause the minimum reduction of potential germination and quality. Many internal and external factors influence the longevity of seeds e.g. seed moisture content, storage temperature, relative humidity in addition to pests and diseases. The relative humidity and temperature during storage need to be controlled especially in the humid tropics to maintain seed quality.

6. Seed Quality Control :

The success of the seed programme requires that the produced seeds of the improved varieties distinguish theirselves from farmers' seed. Seed quality control in most countries is the responsibility of an independent government agency which carries out checks at most stages to ensure high quality seeds. Seed quality attributes include purity, germination, health, weed seeds control , moisture content and other characteristics. Quality control is carried out through testing, certification and legislation.

7. Agricultural Extension :

Most farmers in the developing countries donot know the difference between seeds and grains. The presence of outreach mechanism like agricultural extension to educate farmers on the benefits of improved seeds is imperative for the success of seed programme. It is preferable to conduct on-farm trials to compare quality seeds of improved varieties with farmers' seeds, to allow them to see the difference between the two types of seeds.

8. Trained Personnel :

The success of seed programmes depends to a great extent on the presence of qualified and trained personnel, including executives, technicians, sale persons and farmers who are involved in the seed production process. Continuous training programme in the different disciplines of seed technology is essential for strengthening the seed programmes.

9. Financial Resources :-

Funding for variety improvement programmes, establishment of laboratories, offices, seed processing facilities and training of personnel is essential. A system of credit facilities must also be established to enable farmers to perchase improved seeds and complementary inputs.

(III) Status of Seed Production in the Arab World

There is a great variation in the environmental and climatic conditions in the Arab world, an advantage that enables most countries to develop their agricultural activities especially production of grains. (Table 1) About half of the Arab countries donot experience any problems as to the availability of the essential elements of agriculture, where large areas of arable land are available in these countries, while a continuous supply of irrigation water exists in some countries like Egypt, Sudan, Syria, Iraq, Morocco and Algeria, (Table 2). Based on the climatic conditions , soil types, and availability of irrigation water, it can be stated that most of these countries have the essential elements to support the development of seed industry for most grain crops and vegetables.

3.1 Variety development and Breeding :

Seed Industry requires a continuous flow of genetically improved varieties. For that Arab countries, especially those depending on agriculture have recently given considerable attention to breeding research. Breeding of wheat, which is the main food crop , have witnessed great improvement in most of the countries, followed by barley, then chickpea and lentils. While, sorghum breeding is very limited and there is no sorghum breeding programme except in Sudan and Yemen.

Since the principal problem in the areas of grain production in the Arab World is scarcity of rainfall and its erratic distribution , besides the high temperature during winter in some wheat production areas, breeding of varieties tolerant to such environmental stresses is the primary objectives of the existing breeding programmes. Productivity of most crops could be increased significantly through the development of new varieties and the use of improved seeds, as most of the cultivated land in the Arab World is cultivated with traditional varieties. (Table 4). Egypt with its intensive agriculture and its dependency on irrigation has the largest area cultivated with improved varieties of grain crops, relative to the total cultivated land in the Arab World. In contrast to grain crops, breeding of vegetable crops is of low priority in the Arab World, and most countries depend on importation of vegetable seeds. The role of vegetable research centres is confined to the evaluation of the imported varieties to determine its suitability to the prevailing conditions in the specific country. Generally, variety improvement in the Arab World, is carried by governmental institutions and the role of the private sectors, whether national or international, is so for negligible.

3.2 Seed multiplication :-

Seed multiplication and the production of certified seeds in the developing countries is mainly carried out by governmental agencies unlike the Western countries, where private seed companies are the main seed producers. In some countries both the private and the public sectors produce certified seeds

due to the lack of improved seeds can reach 30% in Yemen, 20% in Sudan, Algeria and Morocco.. It dropped to 15% in Iraq,, Syria and Jordan and reached 10% and 3% in Tunisia and Egypt respectively.

5.4 AOAD is providing Technical assistance to Yemen through secondment of onion breeder to supervise the Executive Project for Onion Seed Production in Yemen. Since, 1989. The main objective of the project is attainment of selfsufficiency from improved onion seed and execution of variety improvement programme to provide varieties suitable for the different geographical regions of the countries. In 1990/91 the project produced 3250kg of onion seeds which was enough to satisfy the seed requirement of the Southern and Eastern Provinces. It is expected to produce 9000 kg in 92/93 a quantity that satisfies about 34% of Yemen need from onion seeds.

5.5 AOAD is conducting a regional study concerning the possibility of producing improved cereal seeds in the Arab World in 1993.

(VI) Recommendations

6.1 Strengthening variety development programmes and establishment of new programmes to develop superior vrieties of the major crop adapted to the different ecological zones in the Arab World, and the promotion of cooperation between the research institutions in the Arab World in the preparation and execution of variety development programmes. This requires training of plant breeders and other research personnel, beside the availability of funding for research programmes. A strong cooperation with the international research centers like FAO, ICARDA, CIMMYT and ICRISAT to benefit from their breeding programmes is highly recommended.

6.2 Establishment of an authority for improved seed production in the Arab countries, to be responsible for production of seed in the Arab World. The budget of the authority should be provided by the member countries. The authority can establish its own research section for variety development and training of researchers or contract the existing research centers and universities to develop new improved varieties.

6.3 Establishment of training centers to provide training for researchers, seed technologists extension workers, technicians, in addition to some farmers in the area of seed technology, extension and marketing.

6.4 Formulation of laws and regulations to guarantee seed quality and safeguard the interest of plant breeders, seed producers and farmers. Seed laws and regulations should be uniform among the Arab countries.

6.5 Conduct a study on the situation of seed production in the area and survey the requirement, the available supply in each country in addition to the number of trained personnel and equipments. This study should put a detailed plan for the establishment of the Arab authority for improved seed production, its budget, the required personnel and the phases of the project execution.

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TABLE (1) : TOTAL AREA CULTIVATED WITH SOME CROPS IN THE ARAB WORLD DURING THE PERIOD 1984-1989

(1000 Ha)

Crops	1984/1986	1987	1988	1989
Wheat	8618.67	9043.64	8074.74	8729.46
Barley	7240.80	7474.52	7371.20	8836.31
Corn	1624.94	1548.25	1705.79	1769.13
Sorghum	7208.20	8028.04	6184.74	9584.65
Faba bean	513.94	573.74	544.77	549.87
Lentils	183.83	219.29	233.38	272.74
Chickpeas	246.95	295.18	254.94	199.79
Tomato	380.43	407.02	381.08	414.02

Source : Statistic Year Book. Vol. 10. Arab Organization for Agricultural Development

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TABLE.(2) TOTAL AREA OF AGRICULTURAL LAND, AND THE CULTIVATED AREA(RAINFED AND IRRIGATED) IN THE ARAB WORLD IN 1988

(1000 Ha)

Country	Agri.Area	Rainfed	Irrigated	%Cultivated
Sudan	58900	8500.0	1890.0	17.6
Yemen	3515	1285.0	230.0	43.1
Jordan	1465	257.4	50.6	21.0
Syria	5864	3647.0	650.0	73.3
Iraq	11500	1720.8	1347.0	26.7
Egypt	4425	-	2550.0	57.6
Tunisia	11000	3833.3	222.1	36.9
Algeria	39536	3133.9	335.7	8.7
Morocco	35250	6955.0*	-	19.7

* Includes rainfed and Irrigated Area.

TABLE :(3): PRESENT STATUS OF VARIETY IMPROVEMENT PROGRAMMES IN THE ARAB WORLD

COUNTRY	WHEAT	BARLEY	SORGHUM	CORN	FABA BEANS	CHICKPEAS	LENTILS
Yemen	*	*	*	*	-	-	-
Lebanon	*	*	-	-	-	*	*
Jordan	*	*	-	-	-	*	*
Egypt	*	*	-	*	*	*	*
Algeria	*	*	-	-	*	*	*
Morocco	*	*	-	*	*	*	*
Syria	*	*	-	*	*	*	*
Iraq	*	*	-	*	*	*	-
Sudan	*	-	*	-	*	*	*
Libya	*	*	-	-	-	-	-
Tunisia	*	*	-	-	*	*	*

* =Exist
- =Non-existence

TABLE: 4 ESTIMATION OF THE PERCENTAGE DECLINE IN YIELD OF SOME CROPS DUE TO LACK OF IMPROVED VARIETIES IN SOME COUNTRIES.

COUNTRY	WHEAT	BARLY	CORN	SORGHUM
Sudan	20	-	-	30
Yemen	30	40	20	20
Iraq	15	15	15	-
Syria	15	25	20	-
Jordan	15	20	-	-
Egypt	03	15	12	-
Tunisia	10	25	-	-
Algeria	20	30	-	-
Morocco	20	20	40	-

TABLE:6.A. ESTIMATED SEED REQUIREMENTS (THOUSAND TONNES) FOR THE ARAB COUNTRIES DURING THE PERIOD 1984-1989 (5Year replacement rate)

CROP	1984-86	1987	1988	1989
Wheat	172.4	180.9	161.5	174.6
Barley	144.8	149.5	147.4	176.7
corn	812.3	774.1	852.9	884.6
Sorghum	1441.6	1605.6	1236.9	1916.9
Faba Bean	25.7	28.7	27.2	27.5
Chickpeas	6.2	7.4	6.4	4.9
Lentils	3.7	4.4	4.7	5.5
Tomato	45.7	48.8	45.7	49.7

TOTAL 6-B: ESTIMATED VALUE OF SEED REQUIREMENT FOR ARAB COUNTRIES DURING THE PERIOD 1984 - 1989

(5 Year Replacement Rate) ((Million US Dollar)

CORP	1984/1986	1987	1988	1989
Wheat	28.4	24.2	28.3	24.8
Barley	23.3	12.2	16.6	23.6
Corn	128.9	86.5	133.7	130.3
Sorghum	287.1	359.7	205.4	347.2
Faba bean	11.5	16.2	8.9	10.8
Chick peas	3.3	2.9	2.0	2.5
Lentils	1.9	3.2	2.5	3.2
Tomato	4.6	4.9	4.6	4.9