

# Focus on Seed Programs

## The Yemen Seed Industry

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### Introduction

Yemen is located in the southern part of the Arabian Peninsula and is bordered by the Red Sea in the west, Indian Ocean in the south, Saudi Arabia in the north and Oman in the East and covers approximately 55.5 million ha. The arable land is about 3.5 million ha (6.3%), and the annual crop area is estimated at 1.5 million ha (Table 1). The farm size and farm holdings are given in Table 2.

The country has five agroecological zones: (1) coastal lowlands (0-200 mm rainfall); (2) southern highlands (200-1500 mm rainfall); (3) central highlands (300-2000 mm rainfall); (4) eastern semi-desert; and (5) Hadramout plateau.

It is estimated that 76.5% of farming is rain-fed, while 23.5% depends on irrigation from pumped wells. Yemen is short of the major food commodities like wheat, rice, flour, cooking oil, sugar and milk products, and the gap is covered by imports. However, the country is self-sufficient in fruits, vegetables and fish.

According to the 2000 estimates, the population is about 17.5 million, of which 7.28 million are engaged in agriculture.

### Agricultural Sector Policy

The Government gives special focus to the agricultural sector. In 1996, it initiated a needs assessment of agricultural inputs and improves its delivery system. In addition, it established an irrigation department under the Ministry of Agriculture and Irrigation for better utilization of water resources available in the country.

The government encourages the agricultural sector and gives priority to:

1. Transform from subsistence to commercial farming through provision of inputs
2. Stabilize the price of agricultural inputs
3. Improve the irrigation system and provision of equipment
4. Implement new strategies in research and seed production
5. Provision of credit to farmers cooperatives, etc
6. Reduce import of vegetables and fruits

Table 1. Area cultivated (ha) and crop production (tones) in Yemen (1995-99)

Crop		Years				
		1995	1996	1997	1998	1999
Cereals	Area	733195	704,206	721,819	770,457	624,315
	Production	802,012	810,177	663,902	646,363	693,713
Pulses	Area	54,174	53,908	57,137	62,468	51,079
	Production	70,411	67,267	66,109	77,973	64,219
Cash crops	Area	156,292	166,489	179,623	188,741	192,717
	Production	128,247	136,781	145,416	162,488	165,566
Vegetables	Area	53,522	57,322	59,254	61,851	62,498
	Production	668,800	703,244	717,631	747,131	759,820
Fruits	Area	74,862	78,901	80,886	84,062	88,104
	Production	402,160	391,278	469,352	554,785	578,573
Fodders	Area	84,558	94,132	101,379	112,125	114,197
	Production	877,957	1,007,750	1,090,639	1,380,571	1,399,477
Total	Area	1,156,607	1,154,958	1,200,098	1,279,704	1,132,910
	Production	2,957,752	2,970,722	3,135,516	3,756,279	3,661,368

Table 2. Farm size and holding in Yemen

Farm size		Farm holding	
Size (ha)	%	Use	%
Small (< 2)	70	< 12 ha	28
Medium (2-5)	15	12-28 ha	41
Large (> 5)	15	29-48 ha	17
		> 48 ha	14
Total	100		100

### National Seed Policy and Laws

In 1995, the agricultural inputs assessment study was conducted which initiated the Seed and Agricultural Services Project (SASP) and the

reform of the national seed program. The reorganization of the national seed sector in 1997 led to:

1. Establishment of three seed enterprises: (i) General Seed Multiplication Corporation (GSMC), (ii) Potato Seed Company (PSC), and

- (iii) Vegetables Seed Company (VSC).
- 2. Establishment of Quality Control Unit
- 3. Enactment of the national Seed Law
- 4. Formation of National Seed Board

In 1998, ‘The Seed and Agriculture Fertilizer Law’ (Law No 20 of 1998) was enacted with the main objective to improve the agricultural sector. The law aims at enabling farmers to have better access and use of agricultural inputs and includes the following elements:

- Registration of new varieties and plant variety protection
- Organizing production and marketing of certified seed
- Organizing import/export of seed and fertilizers
- Encourage private sector investment in seed
- Remove restrictions on source of breeder seed
- Monitoring impacts of fertilizer on environment

The law makes provisions for the establishment of ‘Consultative Council for Seeds and Seedlings’. At present there is a National Seed Board (NSB) under the chairmanship of the Minister of Agriculture and Irrigation. The members of the Board include the representatives of the Ministry of Agriculture and Irrigation (Minister, Under Secretary and Assistant Under Secretary for Agricultural Affairs), agricultural research, public and private seed companies and agricultural cooperatives.

The law requires the establishment of a national registry for seeds and seedlings. Plant variety protection will be granted to

breeders for varieties registered in ‘the protected plant varieties registry’.

### **Plant Variety Protection**

While the government supports the public breeding program, the seed law guarantees breeder’s rights to encourage domestic and international private companies to participate in plant breeding and variety development.

A list of quarantine pests was prepared for the draft plant quarantine regulation submitted for approval by parliament. The General Directorate for Plant Protection under the Ministry of Agriculture is responsible to implement the quarantine regulations.

### **Historical Background**

**B**efore the reunification in 1990, there were four formal organizations dealing with seed production and supply in the South and North Yemen. These organizations were supported by different donors to produce and supply seed of major agricultural crops in the country.

These organizations were:

*Seed Multiplication Project:* The Seed Multiplication Project (SMP) was established in 1979 with the assistance of the Food and Agriculture Organization of the United Nations (FAO), and later supported by the European Economic Community (EEC) in northern governorates to multiply and distribute seed of improved cereal varieties.

*Potato Seed Project:* The Potato Seed Project (PSP) was started in 1977 through the support of the Government of The Netherlands to introduce, produce and distribute seed potato of imported varieties.

*National Seed Center:* The National Seed Center (NSC) was established in 1975 with the assistance of the FAO and United Nation Development Program (UNDP) in the southern governorates to produce improved seed of cereals, cotton and potato.

*Onion Seed Project:* The Onion Seed Project was initiated with the assistance from Arab Organization for Agricultural Development (AOAD) in Hadramout governorate.

After the reunification of Yemen in 1990, the Seed Multiplication Project (SMP) and the National Seed Center (NSC) were merged into a new entity called the National Seed Multiplication Center (NSMC) under the General Directorate of Plant Production in the Ministry of Agriculture and Water Resources (MAWR) for an overall coordination of the seed activities except potatoes.

Later on under the Seed and Agricultural Services Project (SASP), the World Bank provided financial assistance (over USD \$2 million) to implement the reform of the seed program and commercialise its operations. The National Seed Multiplication Center was reorganized which includes:

1. Reducing its workforce from 237 to 117
2. Reducing the NSMC branches from 11 to 5
3. Restructuring the seed farms as independent and self-supporting units
4. Reducing the financial deficit and dependence on government support
5. Improving the management and control of its assets and revenues
6. Encouraging local seed production systems
7. Encouraging testing of varieties for rainfed agriculture

## **Agricultural Research and Crop Improvement**

**A**gricultural research started in the 1950s in Al Koad Research Station handling agricultural and horticultural crops. Initially variety development was carried out on cotton where long staple varieties were evaluated for their adaptation and performance. In the 1970s additional agricultural research stations were established in Seiyun and Taiz. At present, the Agricultural Research and Extension Authority (AREA) is the main organization responsible for generation and transfer of agricultural technology. AREA has established regional agriculture research centers in different parts of the country to cover various crops and agroecological zones of the country (Table 3). AREA maintains close collaboration with national and international research centers such as CIMMYT, ICARDA, ICRISAT, etc. In addition, some universities are also involved in agricultural research.

### **Variety Development**

In the past agricultural research and crop improvement is predominantly a public sector activity. However, the new seed law encourages the private sector to enter variety development. Under the umbrella of SASP some seed companies and GSMC started variety development and evaluation on a contractual basis.

Introduced varieties are tested at the agricultural research stations and sub-stations in different ecological zones. These varieties first enter observation nurseries for one to two seasons to evaluate their adaptability and for desirable characters. Varieties selected from observation trials are further tested for yield, pest resistance and desirable agronomic characters in at least 4-5

locations for two seasons. At the end varieties are tested in larger plots under farmer's conditions and on the basis of

farmer selection and performance (participatory breeding program) submitted for release and registration.

Table 3. Agricultural research stations in Yemen

Station	Location	Crops handled
Al-Boun	Northern highlands	Wheat, legumes
Al-Koad	Lahj plain	Maize, sorghum, sesame, cotton
Dhamar	Central highlands	Wheat, barley, legumes
Marib	Eastern region	Wheat
Seiyun	Hadramout pletau	Wheat, fodder crops
Surdud	Tihama lowlands	Millet, Maize, sorghum, vegetable
Taiz	Southern highlands	Maize, sorghum

### Variety Release and Registration

According to the new seed law, the breeder or their representatives submit their application for new varieties to be registered in the variety catalogue and register. Variety release and registration require testing for DUS and VCU.

The Technical Committee under the National Seed Board is responsible for variety release and registration. The evaluations are conducted on contractual basis for specified number of years. Accepted varieties are named and approved by the National Seed Board and notified in the official gazette. The number of released varieties is given in Table 4.

There are three types of registers: (i) General register for varieties, (ii) Register

for variety certification (certified seeds) and (iii) Register for protected varieties.

### Variety Maintenance

Under the new seed law the breeder or the originator of the new variety is responsible for variety maintenance and supply of the breeder seed. AREA is responsible to maintain cereal and legume varieties as well as further multiplication of pre-basic and basic seed.

### Seed Production

There are five classes recognized for seed multiplication: breeder, pre-basic, basic, certified 1 and certified 2. Breeder seed is produced by AREA. The seed farms operated by the GSMC produce pre-basic and basic seed while certified seed is produced on contract with farmers.

Table 4. List of varieties recommended from in Yemen (1970-2000)

Crop	Number	Varieties
Barley	1	Arivat AREA 1970
Bread wheat	11	Sonalika, Mukhtar (Veery), Aziz (Seri), Marib-1 (Pavon), Al-Ahagaf, Kylansona, AREA 14, AREA 15, AREA 13, Hadramout, Seiyoun
Millet	2	Tihama 2, Murkub
Maize	5	Khumultar, Kinga 36, Taiz 2, Tihama 1, Tihama 2,
Sorghum	7	Baini, Dabar, Gariba, Kadasi, Saifi, Seipon, Tajarib
Faba bean	2	FLIP 84 14-FB, Giza - 3
Lentil	2	FLIP 84-14-L, Precoz
Cowpea	2	Peq- 1, TVU
Beans ( <i>Phaseolus</i> )	2	PO2-1, Lina 24
Ground nut	1	Ashford
Sesame	2	White, Red
Potato	3	
Onion	2	
Cotton	4	

The General Seed Multiplication Corporation (GSMC) was established by a presidential decree No. 226 on 3 September 1998. The Corporation has an overall responsibility for seed production of major crops and has seven branches located in different parts of the country

(Table 5). The GSMC produces all certified seed on contract with seed growers. The theoretical national seed requirement for cereals is shown in Table 6 whereas the amount of seed produced from 1996 to 2000 is given in Table 7.

Table 5. List of seed centers and crops handled by the GSMC

Branch	Sub-branch	Location	Crops handled
Al-Garabeh	Seed farm	Coastal plains	Cereals, oil crops, vegetables
Dhamar	Sana'a	Central/northern	Wheat
	Yarim	Highlands	Barley
Lahj	Taiz	Plains	Maize, sorghum, cotton
Marib	Marib	Eastern region	Wheat
Seiyon	-	Hadramout plateau	wheat
Shiraa	Seed farm	Central highlands	Cereals, legumes
Wadi Khair	Seed farm	Plains	Cereals, oil crops, vegetables
Zabid	Surdud	Coastal plains	Maize, sorghum, millet

Table 6. National seed requirement and coverage of certified seed

Crop	Area (ha)	Seed rate kg/ha	Total seed required (t)	Renewal rate	Certified seed required (t)	Certified seed produced (t)	% produced
Barley	49,573	100	4,907	5	981	4	0.45
Wheat	10,422	140	14,591	5	3,000	683	23.4
Maize	41,750	35	1,461	4	365	12	3.2
Sorghum	44,226	20	884.5	5	2,500	69	4
Millet	95,600	17	1,625	5	510	138	42.6
Potato	14,233	3,000	42,699	3	14,233	2,000	14

Table 7. Certified seed production (tonnes) from 1996-2000

Crop	Year				
	1996	1997	1998	1999	2000
Barley	3.8	-	10.4	1.7	5
Wheat	683	726	262	648	860
Maize	20	3.7	5.3	14.2	20
Sorghum	78	80	80	64	194
Millet	154	142	145	101	89
Potato	2,120	2,671	1,987	2,527	1,896
Onion	-	-	-	2.8	10.6
Total	3058.8	3622.7	2489.7	3358.7	3074.6

The potato Seed Company is based in Dhamar and responsible for potato seed production and marketing. The company covers about 12 % of potato seed requirement in the highlands and about 16% in the low lands.

The Vegetable Seed Company is based in Seiyun and deals with onion seed production and marketing.

### Seed Processing and Storage

Seed processing is carried out at five seed centers located in Dhamar, Hadramout, Marib, Taiz, Yarim and Zabid (Table 8). In addition, there are also separate processing centers for potato and onion in Dahamar and Wadi Hadramout, respectively. The seed plants have nominal capacities ranging from 1 to 2 tonnes/hour (actual capacity of 0.5 to 1.5 tonnes/h).

Table 8. Available seed processing and storage facilities

Region	Sub-branch	Processing capacity (t)	Storage capacity (t)	Crops handled
Northern highlands	Dhamar	1.5	1,200	Wheat
	Sana'a	0.5	300	Wheat
	Yarim	2	800	Barley?
Southern highlands	Taiz	0.5	?	Maize, sorghum
Eastern region Tihama	Marib	0.5	+	Wheat
	Surdud	0.5	750	Maize, sorghum, millet
	Zabid		750	
Hadramout	Seiyoun	1	600	Wheat, onion
Dhamar	-	-	2,500	Potato

### Seed Marketing and Distribution

The GSMC, PSC and VSC are officially responsible for seed marketing and distribution of their mandate crops. Moreover seed is also distributed through various branches and sub-branches as well as agricultural

### Seed Cleaning

Roeber 100 and 200 machines are used for seed cleaning; and each machine is equipped with air screen, indented cylinder and a treater. the cleaning loss is about 10-12%.

Wheat and barley seed is treated with Vitavax 200 (carboxin + thiram). Maize, sorghum and millet are treated with actellic (pirimiphos-methyl) against storage pests. Seed is packaged in 40kg bags.

### Seed Storage

Each branch has seed storage facilities (Table 8). All wheat and other cereal seed are stored in the highlands where storage is not a problem because of low temperature and humidity. Unconditioned storage in lowland coastal region leads to rapid deterioration of seed.

offices, extension services and cooperatives. The private sector is involved in marketing and distribution of imported vegetable seed, and some locally produced seed. However, farmer-to-farmer diffusion continues to play an important role.



The public sector pays a premium to contract seed growers based on the quality of seed produced. For example, GSMC pays a premium of over 20% and provides seed and other inputs to seed growers including farm machinery and equipment. It also provides technical advice and supervises seed growers. Almost 75% of seed produced by growers is purchased by GSMC and PSC.

The price of cereal seed covers only half the actual cost of production whereas the government subsidizes the remaining cost.

Potato and onion seed production and marketing is based on profitability.

The cooperatives play a major role in providing subsidy to the farmers by supporting grain selling prices. For example the cooperatives pay 20% more than market price for grain determined at harvesting time.

In the past (1992 - 1994) the raw and cleaned seed price for wheat seed remains the same. However, since 1995 the cleaned seed price is about 30% more than raw seed purchase price.

Table 9. Comparison of grain and seed price in 1999/00 (USD\$/kg)

Crop	Grain	Seed	Seed/Grain (%)
Wheat	0.24	0.37	154
Barley	0.24	0.31	129
Maize	0.24	0.34	142
Sorghum	0.22	0.34	155
Millet	0.34	0.28	82
Faba bean	0.74	0.56	76
Lentil	0.50	0.62	124
Pea	0.94	0.78	83
Cow pea	0.43	N/A	N/A
Fenugreek	0.78	0.68	87
Potato	40	80	200
Onion	21	27	128

*Note:* USD \$1 = 160 Yemeni Rials

### International Seed Trade

The new law allows free market for seed import and/or export, but the General Directorate of Plant Production should legally approve it. The Quality Control Unit and Plant Quarantine Service assist the Directorate

in ensuring the quality of the seed imported. The imported seed should have a necessary certificate which shows the origin, quality and health of the seed lot.

Seed import is mainly focused on vegetables. The quantity of imported seed is shown in Table 10.

Table 10. Quantity of vegetable seed imported (kg) from 1995-1998

Crop	Year			
	1995	1996	1997	1998
Cabbage	1395	300	1050	nil
Carrot	10,858	8,500	9,507	8,009
Cucumber	4,320	2,500	1,199	1,343
Egg plant	200	400	137	85
Lettuce	0	0	0	300
Okra	1,220	1,030	1,500	1,500
Onion	7,513	7,500	5,999	10,268
Pepper (hot)	180	250	0	0
Pepper (sweet)	485	700	872	1,115
Radish	50	70	2,389	2,917
Squash	4,462	4,500	1,997	1,480
Sweet melon	3,558	3,000	2,789	2,154
Water melon	10,325	11,200	10,565	14,600
Total	56,433	52,950	46,410	55,782

*Source:* Department of Horticulture, Directorate of Plant Production, MAI

### Seed Quality Control

Until 1990, there was no official organization responsible for seed quality control. However, there was an internal seed quality control within the seed production centers, both in the northern and the southern governorates. At present there is national seed regulation to support seed quality control and certification. Field and seed standards for locally produced and imported seed have been established and used.

In 1998, the Quality Control Unit was established as an independent certification

agency. The quality control system consists of field inspection and seed testing. Field inspection is based on OECD schemes whereas seed testing is based on ISTA rules. The area inspected and the number of samples analyzed is shown in Table 11.

### International Membership

Yemen is the founding member of the WANA Seed Network and a 'lead country' for a survey of rules and regulations to establish seed companies.

Table 11. Area inspected and number of samples tested from 1998-2000

Purpose	Year		
	1998	1999	2000
<b>Field Inspection</b>			
Area inspected (ha)	147	346	502
Area approved (ha)	117	320	471
% Approved			
<b>Seed Testing</b>			
Number of samples analyzed	80	125	197
Number of tests conducted	300	414	652
<b>Wheat seed quality (average)</b>			
Physical purity (%)	97.5	96.1	97.7
Germination (%)	91	86	94.0
Moisture (%)	12.5	10.7	9.7
Thousand seed weight	33.8	34.8	36.8

### Constraints in the Seed Sector

Some constraints of the national program in variety development and release, seed production and distribution are listed below:

1. Lack of well-organized plant breeding programs to develop new high yielding varieties
2. Lack of variety maintenance leading to quick deterioration of released varieties
3. Lack of released varieties suitable for rainfed agriculture
4. Small land holding, traditional production techniques, limited irrigation water and inputs leading to high production costs
5. Lack of infrastructure particularly in southern and eastern governorates

6. Lack of technically qualified staff in the seed sector
7. Inefficient extension services linking agricultural research and farming communities

### Recommendations for the Seed Sector

The following are key recommendation to improve the national seed industry in the country.

1. Establish appropriate linkage between variety maintenance and seed production
2. Provision of infrastructure for the seed farms (machinery, pumps, water)
3. Providing training for seed staff and farmers



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