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# Focus on Seed Programs

## The Seed Industry in Oman

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### Introduction

The Sultanate of Oman occupies the eastern corner of the Arabian peninsula, stretching more than 1700km from the Strait of Hormuz in the north to the frontiers of Yemen in the south. The Musandam Peninsula, the most northern point of Oman is separated from the rest of the country by Fujaira, which is one of the United Arab Emirates.

The country is located between latitudes 16° 40'N and 26° 20'N and longitude 51°E and 59° 40'E. The total area is 30 million ha of which mountains, deserts and coastal plains occupy 4.5 (16%), 24.6 (81%) and 0.9 (3%) million ha, respectively.

The climate varies from arid in the interior regions, to humid in coastal areas to tropical in the southern parts of the country with the temperature range from below zero (in Jebel Akdar and Jebel Shams) to 50°C in the summer. The rainfall is erratic without any specific rainy season except in Dhofar region where there is heavy rainfall during *kharif* (July-September) period. Elsewhere rain mostly falls between November and February. The average annual rainfall is about 100 mm.

Agriculture plays an important role in the economy. The total cultivated area is about 73,415 ha of which 60% is located in the coastal areas. The major crops grown are fruit trees (date, lime, mango, banana), vegetables (cucurbits, garlic, onion, tomato, watermelon) and field crops (wheat, barley, maize, sorghum, cowpea, alfalfa, Rhodes grass). However, date palms occupy the largest area.

Agricultural crops are grown mostly in Al'Dakhliya, Al'Dhahira, Sharquiya, Musandam and on a limited scale in the southern part of Dhofar region. All crops are irrigated except in Musandam region where rainfed crops are grown. Irrigation is either by flood, drip or sprinklers.

Irrigation from ground water, particularly on the coastal plain, has led to the build-up of salts in some areas. Efforts are being made to overcome the problem of salinity through appropriate irrigation and drainage practices to avoid further damage to the environment. There is a growing interest in testing salt tolerant crops and varieties.

Wheat and barley are grown mainly in Al'Dakhliya, Al'Dhahira and Sharquiya

regions under irrigated condition and on a small scale in Musandam area under rainfed condition. Moreover, barley is also grown for fodder as pure stands or as mixture with alfalfa throughout the country.

In the Batinah region, farmers grow mostly fruit trees, vegetables and fodder crops such as alfalfa and Rhodes grass. In Dhofar region, apart from fruit trees, vegetables and fodder crops are also grown along the coast. The major field crops grown in Sultanate of Oman are indicated in Table 1.

Table 1. List of major crops grown in Sultanate of Oman

Cereals	Wheat, Barley, Sorghum
Legumes	Chickpea, Mung bean, Lentil, Faba bean, Pigeon pea
Oilseeds	Groundnut, Sesame, Safflower, Sunflower
Fodder grasses	Maize, Sorghum, Pearl millet, Rhodes grass, Elephant grass
Fodder legumes	Lucerne, Lablab, Cowpea
Fiber crops	Cotton
Sugar crops	Sugarcane
Stimulants	Tobacco

New crops such as mung bean, sunflower, buffel grass, green panic, signal grass, Sudan grass and Siratro have been introduced to test their adaptation to Omani conditions.

The estimated area and production of

different crops (grain and fodder) during 1999 is given in Table 2.

Table 2. Area and crop production in Sultanate of Oman

Crops	Area (ha)	Production ('000 tonnes)
Wheat	325	1.00
Barley	1,285	3.79
Sorghum	3201	14.7
Sugarcane	109	1.00
Others	1,692	4.90
Alfalfa	11,321	472.15
Rhodes grass	6492	275.29
Elephant grass	2949	13.72

## National Seed Policy and Laws

The National Seed Policy and regulatory framework is being under development as a constituent/chapter of Agricultural law pertinent to regulations for varieties, quality control, certification and seed trade, which will be enacted by the Royal Decree. This Royal Decree on Agriculture will replace all the previous laws concerning similar aspects on agriculture.

In October 2000, the Royal Decree No. 92/2000 issued the plant variety protection law. The decree contains two chapters and 24 articles. The implementing regulation of the law will cover the following aspects: general provisions, conditions of the breeder's rights, scope of protection, transfer and loss of rights, joint ownership of certificates, filing of applications for plant variety certificates, prosecution of applications for plant variety certificates, issue of plant variety certificates and legal proceedings. The PVP executive regulations have been already finalized which will be published in the near future.

The Ministry of Agriculture and Fisheries (MAF) would be responsible to enforce PVP law.

### **Agricultural Research**

In the 1970s and 1980s agricultural research on wheat, barley and other field crops was carried out at Wadi Quriyat agricultural research station in the interior region of the country. At present major research on field crops are conducted in six stations based at Al-Kamil, Jimah, Nejid, Rumais, Salalah and Sohar. The research stations at Al-Kamil, Jimah and Salalah deal with grain, fodder and fruit crops whereas the stations at Nejid, Rumais and Sohar deal with fodder and fruit crops. The agricultural research includes variety development, evaluation and agronomic management. The plant protection units conduct research on diseases and pests. Several results have been obtained in different aspects of crop production. Since 1999, the Director General of Agriculture and Assistant Director General for Agricultural Research and Extension are responsible for the activities of agriculture research.

### **Genetic Resources Conservation**

The germplasm of local landraces has been collected in collaboration with IPGRI and ICARDA and stored in Oman and stored at ICARDA gene bank. Moreover, wild relatives of wheat and barley were also collected from the mountain regions to study the origin and distribution of these crops in the Arabian Peninsula.

### **Variety Development**

For wheat, barley and chickpea international nurseries or regional trials are received from ICARDA and ACSAD

whereas for other crops such as vegetables, annual and perennial forage grasses and legumes, fodder beet, *Atriplex* spp, etc. are received from seed companies in Australia, Holland, India, USA, etc. At present wheat, barley and chickpea crosses for disease resistance are obtained from international nurseries supplied by ICARDA and from organizations such as ICRISAT for crops such as groundnut, forage sorghum and pearl millet etc. The introduced lines are tested for three years at research stations and selected for high yields and other desirable agronomic characters. The selected lines are further tested for one year in larger plots on farmers' fields, which forms the basis for final selection and release of the variety.

The high yielding elite genotypes are recommended for release based on the recommendation of field crop scientists who are involved in carrying out variety performance trails in different locations and years at research stations and farmers' fields. The list of recommended crop varieties is given in Table 3. In the future the Ministry of Agriculture and Fisheries (MAF) would be responsible to enforce PVP law and carrying out DUS tests.

However, quite a large crop area is under local landraces. The wheat landraces are Cooley (covers 80% of local area), Sarraya, Missain, Hamira and Walidi. The barley landraces are named after the area in which they are grown and known as Al'Dakhliya, Sharquiya, Bathini and Duraqui (Musandam area). Many local landraces are also available for crops such as chickpea (Omani), cowpea (Omani, Dhofari), sorghum (Omani, Rustaqui) and alfalfa (Omani, Bathini, Dhofari, Sharqui, Quiyahi).

Table 3. List of recommended crop varieties

Crops	Varieties
Wheat	Mexipak, Sannine, WQS151, WQS160, WQS302, WQS305, WQS308, Jimah1, Jimah2, Jimah 101, Jimah 102, Jimah 103, Jimah 107, Jimah 110, Jimah 125, Jimah 132
Barley	Beecher, Jimahh5, Jimah6, Jimah 51, Jimah 53, Jimah 54, Jimah 58, Jimah 98, Jimah 136
Cowpea	Jimah 2, Jimah3, Jimah 4
Chickpea	ILC237, Jimah7, Jimah8, Jimah 1, Jimah 2, Jimah 17, Jimah 18
Dry peas	ARC-2 (Rumais2), ARC-3 (Rumais3), ARC-4 (Rumais4), ARC-5 (Rumais5), (ARC-6 (Rumais6), ARC-7 (Rumais7)
Mungbean	PS-16, Sona, PDM 84-13
Sesame	Giza 23
Safflower	A-300, A-1
Sunflower	Turkey-79, Miak
Maize	Giza2, Katamani503, Hybrid 622, Irat8, Sohar1, Sohar2, Rumais Composite 1, Rumais Composite 2, Rumais Composite 3
Sorghum	Sugar drip, Honey drop, Fs x Dekalb 17
Fodder Oats	Marloo, ARC-1 (Rumais1)
Rhodes grass	Callide, Katambova, Samford, Elamba, Boma, Pioneer
Alfalfa	ADLL 6725, CUF 101, Cundor, DK 187, Maxidor, Sequel
Fodder beet	Peramono, Petra, Anissa

Wheat and barley are major field crops where a substantial number of improved

varieties have been released. The details of

wheat and barley varieties grown are given in Table 4.

Table 4. Characteristics of released wheat and barley varieties

Varieties	Source	Year Released	Yield (t/ha)
<b>Wheat</b>			
Mexipak	Pakistan	1972	2.1
Sannine	Lebanon	1974	3.2
WQS160	ICARDA	1985/86	3.2
WQS151	ICARDA	1985/86	2.9
WQS308	CIMMYT/ICARDA	1992/93	3.1
WQS305	CIMMYT/ICARDA	1993/94	3.5
Jimah1 <sup>1</sup>	CIMMYTT/ICARDA	1996/97	3.0
Jimah2 <sup>1</sup>	CIMMYT/ICARDA	1996/97	3.9
Jimah 101	CIMMYT/ICARDA	1997/98	3.25
Jimah 102	CIMMYT/ICARDA	1997/98	3.3
Jimah 103	CIMMYT/ICARDA	1997/98	3.1
Jimah 107	CIMMYT/ICARDA	1998/99	4.9
Jimah 110	CIMMYT/ICARDA	1998/99	4.9
Jimah 125	CIMMYT/ICARDA	1999/00	4.9
Jimah 132	CIMMYT/ICARDA	1999/00	4.0
<b>Barley</b>			
Beecher	ICARDA	1974	3.9 <sup>2</sup>
Jimah 6 <sup>1</sup>	ICARDA	1992-93	3.8
Jimah 51	ICARDA	1993-94	4.1
Jimah 53	ICARDA	1993-94	3.3
Jimah 54	ICARDA	1993-94	4.0
Jimah 58	ICARDA	1993-94	3.3
Jimah 98	ICARDA	1999-2000	4.6
Jimah 136	ICARDA	1999-2000	4.5

<sup>1</sup> Recommended but still not grown by farmers; <sup>2</sup> Green fodder yield is 25.3 t/ha

### Agronomic Research

In Oman there are two cropping seasons: winter and summer. Winter crops are planted in October or November and include wheat, barley, maize, rye, oats, pea, chickpea, alfalfa and Rhodes grass. The

summer crops are planted in March-April and include sorghum, millets, cowpea,

sesame, maize (fodder), alfalfa and Rhodes grass.

Agronomic practices were identified and recommended for all major crops. The seed and fertilizer rate and expected grain yield are given in Table 5. Although all crops are grown under irrigated conditions the yield level is low due to unfavorable climatic conditions.

Table 5. Agronomic practices recommended for field crops

Crop	Seed rate kg/ha	Fertilizer <sup>1</sup> (N-P-K)	Yield kg ha <sup>-1</sup>
Wheat	100-25	150-90-60	2500-3000
Barley	100-25	100-90-60	2500-4000
Maize	35-50 <sup>2</sup>	200-100-50	2500-4000
Sorghum	30-40 <sup>2</sup>	150-100-50	2500-3000
Cowpea	100-25	100-100-50	1000-2500
Chickpea <sup>3</sup>	75-100	100-100-50	1500-2000
Dry pea <sup>3</sup>	80-120	100-100-50	1500-2000
Sesame	6-10	100-100-50	700-1500
Alfalfa	25-30	200-120-250	150-175 <sup>4</sup>
Rhodes grass	10-12	1200-150-150	100-125 <sup>4</sup>
Oats (fodder)	100-125	100-90-60	1000-1500

Note: <sup>1</sup>P and K are applied at sowing time whereas N is applied at planting and as split [4 splits (wheat, barley, oats); 3 splits (sorghum, maize); 2 splits (chickpea, cowpea, dry pea, sesame); 1/10 after each cut (alfalfa, Rhodes)]; <sup>2</sup>For fodder seed rate is 75-90kg/ha<sup>-1</sup> for maize and 50-70kg/ha<sup>-1</sup> for sorghum; <sup>3</sup>Chickpea and dry pea are not inoculated and no bacterial nodules present in the soil, so higher doses of N are used; <sup>4</sup>Green fodder yield in tonnes.

### Seed Production and Supply

In Sultanate of Oman the national seed program is still at an early stage of development. Seed production was started in 1979 under the direct supervision of agricultural research stations and restricted to Al'Dakhliya area. However, the program was later expanded to cover Al'Sharqiya and Al'Dharhira and become under the direct supervision of the extension service.

The Government undertakes the responsibility of seed production, particularly of some important crops such as wheat and barley. Breeder (by ear to row method) and foundation seed of recommended varieties are maintained and multiplied at regional agricultural research centers, under the supervision of crop scientists.

The foundation seed is supplied to the

agricultural extension service, which produce certified seed of wheat and barley on contractual agreement with farmers. The seed of other crops is multiplied on limited scale at agricultural research stations. The seed is produced under the direct supervision of the extension service, but a research-extension committee oversees the program. The area planted for seed production during the last three years is presented in Table 6.

The extension service is responsible for selection of contract farmers; provision of seed, fertilizers, plant protection services; technical backstopping and supervision; and financial support for roguing seed crops. It also provides gunny bags and purchase seed at premium price, treat and store until distribution. The farmer provides the land and irrigation and is responsible for general cultivation and harvesting of seed crops.

Table 6. Area and production of certified seed in Oman

Region	Crops	Area (feddans)/ Production (tonnes)	1998/9	1999/0	2000/1	2001/2
Al-Dakhliya	Wheat	Area (f)	61	61	62	58
		Production (t)	61	61	74.4	75.4
	Barley	Area (f)	7	7	13	14
		Production (t)	5.6	5.6	20.8	22.4
Al- Dhahira	Wheat	Area (f)	38	38	41	45
		Production (t)	38	38	49.2	58.5
	Barley	Area (f)	7	7	9	13
		Production (t)	5.6	5.6	14.4	20.8
Al-Sharqiya	Wheat	Area (f)	34	33	32	9
		Production (t)	34	33	38.4	11.7
	Barley	Area (f)	3	3	7.5	6
		Production (t)	4.8	4.8	12	9.6
Batinah	Wheat	Area (f)	33	22	23	28
		Production (t)	33	22	27.6	36.4
	Barley	Area (f)	-	-	-	3
		Production (t)	-	-	-	4.8
Muscat	Wheat	Area (f)	2	2	-	-
		Production (t)	2	2	-	-

	Barley	Area (f)	-	-	-	1.5
		Production (t)	-	-	-	2.4
Musandam	Wheat	Area (f)	2	25	25	20
		Production (t)	2	25	25	20
	Barley	Area (f)	-	-	-	2.5
		Production (t)	-	-	-	4

Most farmers produce their own alfalfa seed. Generally seed is harvested from alfalfa crop of 4-5 years. This practice of harvesting seed from old stands applies a strong selection pressure in favor of those plants which have survived several years of cutting. It will tend to ensure that these important 'survival' characteristics are preserved and enhanced in successive multiplication. This may explain in part the widespread reputation of the alfalfa variety known as 'Omani' in the region.

For vegetables, there is no local seed production program either by the Government or private sector. Several international seed companies have branches in the country in association with local seed companies or agents. These companies import seed of promising varieties from USA, Australia, Arab, Asian, African and European countries and supply the seed directly to the farmers or through the Government. However, some farmers produce the seeds of local cultivars of vegetables like onion, garlic, carrot, cucumber, musk melon and sweet potato.

### Seed Processing and Storage

Seed processing is carried out by the agricultural extension services in different locations with the limited facilities available. After cleaning seed is bagged in new bags provided by the extension service where the variety name and the quantity are indicated. The seed is fumigated and stored in temporary storage at the regional offices at Dhahira, Ibra, Ibri

and Nizwa of the Ministry of Agriculture and Fisheries under the supervision of Director Generals of the regions. The seed is distributed free of cost to farmers for general cultivation.

### Seed Marketing and Distribution

Wheat and barley seed is distributed to interested farmers free of cost while in other crops like vegetables, perennial forages, etc. farmers purchase the seed from various companies that import seed for sale. Besides some farmers sell their own seed of

indigenous vegetables in the local market.

### Seed Quality Control

Seed quality control consists mostly of purity and germination tests which are carried out both for locally produced and imported seed before distribution to the farmers. The newly established Seed and Plant Genetic Resources Laboratory tests samples of locally produced wheat and barley seed and the imported seed of perennial grasses and vegetables for purity and germination. At present there is only laboratory standards both for local production and/or imported seed. The standard for commercial seed is given in Table 7.

Table 7. Laboratory seed standards for commercial seed

Crop	Purity (minimum %)	Weed seeds (maximum, no/kg)	Defect seeds (maximum %)	Germination (minimum %)	Moisture (maximum %)
Wheat	98	10	1.5	85	14
Barley	98	10	1.5	85	14
Maize	98	10	2.5	90	14
Sorghum	97	2000	1.5	75	14
Alfalfa	97	1000	-	60	10
Rhodes grass	50	2000	-	40	10
Fodder beet	97	-	-	60	10

### International Seed Trade

Seed companies that have valid permit issued by the Ministry of Commerce and Industry import the seed of mainly vegetables and perennial forages like Rhodes grass from companies in Africa, Asia, Australia, Middle East, Europe and USA. The Ministry of Agriculture and Fisheries issues licenses for companies importing particular seed material.

At present there is no specific seed law to control seed import except the quarantine regulations of the Law of Agriculture Quarantine (Royal Decree No. 49/77) concerning nursery plant and seed material. However, the new Law on Agriculture will be enacted in near future that includes a chapter on seed covering all aspects. There are quarantine centers both at the airport and at entry borders to enforce the regulations. The Ministry of Agriculture and Fisheries and Royal Oman Police enforce the quarantine law.

## Constraints in the Seed Sector

The Ministry of Agriculture and Fisheries are strengthening the national seed sector to overcome some major constraints such as shortage of trained local personnel and seed policy.

The Government undertakes seed production of important field crops such as wheat and barley on a limited scale. The farmers produce their own seed for crops such as chickpea, cow pea alfalfa, sorghum, etc. For example, farmers produce seed of local varieties of alfalfa from old stands (>5 years) just by skipping cutting in early/late winter and harvesting seed when the crop is mature.

Since there is no local seed production for vegetable crops and the country is entirely dependent on import. The private seed agencies sell imported seed at fairly high prices. Furthermore, there are no local companies coming forward to invest in seed production of indigenous popular cultivars of different crops such as alfalfa, vegetables (garlic, onion, carrot, cucumber, musk melon, sweet potato etc.) to expand the area in these crops.

## Recommendations for the Seed Sector

The development of seed industry should be a priority for the progress of agriculture in the country. At

present there is limited supply of seed of agricultural crops and vegetables, respectively by the extension service and the private seed companies. There is strong need to develop local capacity for production and supply of quality seed in the country for all the major crops grown by the farmers. In the years to come, seed supply could assume greater importance and the seed demand expected to continue increasing for commercial crop production.

A concerted effort to strengthen national seed program would help to (a) increase agricultural production through adoption of improved varieties and use of quality seed, (b) enhance systematic and rapid multiplication of seed of new varieties, (c) facilitate timely supply of seed to the farmers, and (d) facilitate seed supply at a reasonable price.

The human resource development, upgrading the skill and knowledge of both professional and technical staff through in-service training or post-graduate studies in seed technology in collaboration with the International Center for Agricultural Research in the Dry Areas (WANA Seed Network) or through other international organizations is very essential. These would help to develop the agriculture of the country and to achieve self-sufficiency in food crops such as wheat by exploiting the potential of modern agriculture.



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