



## Research Article

# An Assessment of Seed Sources for Cultivation of Field and Vegetable Crops in Balochistan, Pakistan

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**Abstract** | To investigate the sources of seed and vegetable crops, this study was carried out during 2017-18 in Balochistan province by interviewing 360 farmers selected from six districts of Balochistan applying multistage cluster sampling approach. Survey data further revealed that 34% farmers produced their own seed. Regarding source of seed, dealers (96.8%) and neighboring (88.8%) farmers were observed to be the major sources of basic seed for multiplication. However, 36.8% of the farmers reported that seed companies are their exclusive source of basic seed. Only 14% of the farmers reported that seed was purchased from public sector. Major seed sources of five crops namely wheat, cotton, rice, onion and tomato were recorded. Survey findings further revealed that informal sector (own, neighbor, and landlord) was common source of seed for wheat (62.3%) and onion growers (64.2%). On the Other hand, formal sources (seed companies and dealers) were common source of seed for cotton (97.7%); rice (92.2%); and tomato (100%) growers. Very negligible contribution of public sector was observed for the supply of quality seed to the farmers. Moreover, majority of the farmers believed that seed of the above-mentioned crops was available with difference sources, however, affordability and quality were the major concerns. Small segment of the farmers were satisfied with quality of seed and the same were recorded as 43.9% wheat, 30% cotton, 56.1% rice, 22.8% onion, and 21.7% tomato growers. Based upon research findings, recommendations were developed for public and private sector for quality supply of seed to the farmers of Balochistan.

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## Introduction

Seed is the elementary input in agriculture and the most important reagent for other inputs to be cost effective. Good seed has crucial role for the quality production. Hence, it is not only important to achieve higher crop yields, but also to earn high economic returns. According to the researches on seed quality,

alone quality seed can raise crop yields by 25 %; and wise decision on combination of other inputs can increase yield levels considerably (Deo *et al.*, 2003).

During last four decades, the seed industry has emerged as one of the most promising entrepreneurs in agriculture sector and many multinational companies and corporations have entered this

agricultural region and competing with other firms. This trend necessitates the opportunities for renewable agriculture which mainly included declining popularity of seed saving. To improving the current structure of the industry, ownership changes from 1996 to 2008 are presented. Accordingly, the movement of seed across the boundary has reinforced to institutionalize seed sector (Philip, 2009).

Balochistan is area-wise largest province of Pakistan but lowest in population among four provinces. The farming economy of Balochistan depends on livestock (especially small ruminants) and fruit production. The total area of Balochistan is 347190 sq km (34.72 million ha) of which an area of 2633.8 sq. km (2.06 million ha) is cultivated. According to the national census (GoP, 2017). The Balochistan population is 12.34 million; comprised of 8.944 million rural population (72.45%) and 4.690 urban population (about 27.55%). Balochistan province is comprised of five ecological zones, right from tropical to sub-tropical temperate, cold and very cold; having multiple cropping patterns with 0-1500 ft ASL to more than 6000 ft ASL. The province has well placed agriculture infrastructure in all the ecological zones.

Unfortunately, overwhelming majority of Balochistan districts are facing challenge of food security; where most deprived and insecure food security districts included Dera Bugti, Kohloo, Loralai, Zobe, Barkhan and Musakhel. The food insecurity situation and poverty are improved in Punjgure, Dalbadin, Noshki, Loralai and Machh districts. It calls attention of policy makers to improve wheat and rice production by increasing yield per unit area. However, one of the reasons of improvement in Balochistan may be the use of certified seed which is the best recognized decision to increase crop yield up to 15%. However, unfortunately, the province is lacking organized seed production programs due to multiple reasons (Hussain *et al.*, 2017; Khan, 2012).

Due to weak vegetable breeding program, seed production system could not be put on scientific lines for the last 70 years in Balochistan; local breeding program in Pakistan has released only 44 varieties of all 42 vegetable crops which are mostly introduction or selection from local and exotic material but from Balochistan, only 8 varieties of six vegetable crops could be released so far (Saleem *et al.*, 2015; Hussain, 2017). Balochistan Agriculture Research and Extension

have infrastructure at gross-root level with agriculture 18 Farms (7753 acres) of agriculture extension. Out of these 18 farms, seed farms are existed at Gidder (Kalat), Gandwaw (Jhal Magsi) and Usta Muhammad (Jaffarabad) with total area of 4683 acres. The potential of these farms is not being utilized entirely; and seed farms could not produce certified seed for their own requirement at the farm. However, due to nonexistence of independent seed corporation, these farms are administratively rootless. Similarly, ARI Quetta has 13 commodity research directorates, research stations and sub-locations with 13 research farms including three seed farms at Quetta (Vegetable Seed Farm), Usta Muhammad (Potato Farm) and Toba Kakri (Pishin) comprised of 1240.32 acres and 174 acres in different agro-ecological zones, respectively. No one has established foundation seed cell for production of pre basic and basic seed; both the departments of research and extension have weak linkages (GoP, 2018; Hussain *et al.*, 2017).



**Figure 1:** Map of Balochistan showing study areas.

#### *Purpose of the study*

It is matter of fact that high quality seed is the most effective input for improving productivity of any crop. Effective use of improved seed can result in higher impact on reeducation of rural poverty. Purpose of the study was to evaluate the access of the farmers to seed of different crops through different sources and to develop recommendations for public and private sector organizations for the supply of quality seed.

#### *Objectives of the study*

The objectives of the study ware (i) to investigate formal and informal sources of supply of seed for different crops; and (ii) to assess farmers' problems regarding access to quality seed.

## Materials and Methods

### Research design

The research design used in this study was descriptive survey because, this type of design is appropriate for obtaining people's perceptions on social issues and social facts concerning current status of the phenomena and/or for describing the nature of existing conditions in a situation (Cohen and Manion, 1980; Trochim, 2000). The descriptive design was selected because the primary purpose of the present study was to evaluate the access of the farmers to seed of different crops through different sources and to develop recommendations for public and private sector organizations for the supply of quality seed.

### Target population (Balochistan Province)

Target population for this study was all the growers of Balochistan province of Pakistan. Balochistan is one of the four provinces of Pakistan. It is the largest province in terms of land area, forming the southwestern region of the country. Its gross geographical area is 347,190 Sq. km which is about 44% of the total geographical area of the country. According to the 2017 census, its population is 12,344,408 which is 5.94% of the total population of the country. In addition, 27.55% of the population lived in urban areas while 72.45% in rural areas (GoP, 2017) with population density being around 36 km<sup>2</sup>.

### Sampled population

The study was conducted in all six divisions of the province. From each division, one district was purposively selected on the basis of relatively more agriculture in comparison of neighboring districts. From each district, one tehsil was selected randomly. From each tehsil, two union councils were selected randomly. From each union council, two villages were selected randomly and from each village, 15 farmers were selected randomly. Thus, the total sample size of farmers was 360 which were selected from six purposively selected districts namely Quetta, Loralai,

Sibi, Nasirabad, Lasbela and Panjgur districts.

### Development of questionnaire

A questionnaire for farmers was developed. The questionnaire was included closed and open-ended questions. The questionnaire contained the following key items of the information: (i) demographic characteristics of the respondents; (ii) farm information; (iii) availability and accessibility of quality seed; (iv) source of seed used; (v) perception of value of assistant sources; and (vi) preparation of own seed.

### Data collection and analysis

The data were collected through face to face interviews with the respondents. Researcher personally conducted in-depth interviews with famers. The data were analyzed by using world known computer package i.e. Statistical Package for Social Sciences (SPSS) and Microsoft Excel (MS Excel). Frequency, %ages, weight-age scores, rank orders, means and standard deviations were calculated.

## Results and Discussion

Keeping in view the objectives of the study, data were collected, analyzed and presented. Efforts were made to discuss the findings of the present study in view of previous studies. Major results/findings of the study are presented hereunder:

### Farmers' demographic attributes

Demographic findings indicate that the average age of the farmers was 45.59 years (mid age) with an average farming experience of 19.37 years (Table 1). Difference between age and experience was around 25 years. Similar findings are reported by Nazir *et al.* (2018) who reported the average age of farmer was about 42 years and 22 years of farming experience, which showed that farmers started independent farming at the age of 25 years.

**Table 1:** Age and experience of farmers.

Statistics	Landlord / Own cultivator		Tenant		Total	
	Age	Farming experience	Age	Farming experience	Age	Farming experience
N	290	290	70	70	360	360
Minimum	20	3	22	4	20	3
Maximum	90	60	65	35	90	60
Mean	45.66	19.48	45.31	18.89	45.59	19.37
SE	0.737	0.577	1.250	1.001	0.641	0.504

**Table 2:** Educational level of farmers.

Educational level	Landlord / Own cultivator		Tenant		Total	
	Count	N (%)	Count	N (%)	Count	N (%)
Illiterate	105	36.2	34	48.6	139	38.6
Primary	15	5.2	2	2.9	17	4.7
Middle	16	5.5	3	4.3	19	5.3
Matic	64	22.1	20	28.6	84	23.3
Inter	33	11.4	7	10.0	40	11.1
Graduate	39	13.4	3	4.3	42	11.7
Above Graduation	18	6.2	1	1.4	19	5.3
Total	290	100.0	70	100.0	360	100.0

**Table 3:** Descriptive statistics of farm size.

Types of farming		Farm size	Crops cultivated				
			Cereal	Vegetables	Others crops	Orchards	Seed purpose
Landlord / Own cultivator	N	290	267	243	107	144	107
	Percent (N)	100.00	92.07	83.79	36.90	49.66	36.90
	Mean (acres)	68.23	14.15	13.85	9.43	6.42	1.28
	SE (acres)	14.963	1.219	1.847	0.954	0.544	0.0489
	Total Area (acres)	19,786	3,779	3,365	1,009	924	137
	% of Area	100.00	19.10	17.01	5.10	4.67	0.69
Tenant	N	70	63	66	45	20	19
	Percent (N)	100.00	90.00	94.29	64.29	28.57	27.14
	Mean (acres)	35.64	7.86	12.95	9.16	5.9	1.368
	SE (acres)	8.201	0.933	2.07	1.755	0.903	0.2191
	Total Area (acres)	2,495	495	855	412	118	26
	% of Area	100.00	19.84	34.27	16.51	4.73	1.04
Total	N	360	330	309	152	164	126
	Percent (N)	100.00	91.67	85.83	42.22	45.56	35.00
	Mean (acres)	61.89	12.95	13.66	9.35	6.35	1.294
	SE (acres)	12.172	1.011	1.517	0.846	0.49	0.0526
	Total Area (acres)	22,281	4,274	4,220	1,421	1,042	163
	% of Area	100.00	19.18	18.94	6.38	4.68	0.73

Regarding educational status of the farmers, it was reported that 38.6% of the farmers were illiterate, having no formal education (Table 2). Similar findings were also reported by GoP (2019) indicating that illiteracy rate was 37.7% in Pakistan during 2017-18, while illiteracy rate was higher (45.7%) in Balochistan. These estimates confirm high rate of illiteracy in the study areas.

#### Farm size

Table 3 unveils descriptive statistics of farm size in acres. On an overall basis, the average farm size was recorded as 61.89 acres. Quite a large difference was recorded while comparing farm size of landlords/own cultivators with tenants. Average farm size of Land-

lord/Own Cultivator was 68.23 acres against 35.64 acres of tenants. Small proportions of farm size were reported as cultivated for cereals (19.18%) vegetables (18.94%) and orchards (4.64%). While very small proportion of the farm size was computed for cultivation of different crops for seed purpose. These results are in connection with Nazir *et al.* (2018) who also reported that the average farm size was 43 acres in Pakistan.

#### Farmer's sources of information about seed

Table 4 divulges the descriptive statistics (average values obtained from likert scale) related to source of information during quality seed procurement. The results indicate that on overall basis, seed dealers were perceived on the great extent, with average



value of 4.45 out of 5 points scale, followed by the neighboring farmers (4.00) and seed companies (2.05), respectively. Segregated data by tenancy status revealed that tenants got relatively more information from neighboring farmers (4.06) in comparison of landlords/own cultivators (3.99). On the other hand, landlords perceived seed dealers with relatively more average score *i.e.* 4.46 for seed dealers and 2.10 for seed companies against the average score of 4.41 and 2.03 for seed dealers and seed companies, respectively as perceived by tenants.

Similar findings regarding sources of information were reported by Bishaw *et al.* (2010) indicating that farmers used multiple sources of information. Farmers (relatives, neighbors, and other farmers) appeared to be the most imperative informal source of information while seed dealers were top ranked, whereas inadequate information was accessible from formal sources.

#### Preparation and sale of seed

Results regarding preparation of seed and its multiplication as well as marketing by ownership status are depicted in Table 5. On an overall basis, 34% respondents were involved in multiplication of their own seed. Further results indicate that 36% landlord/own cultivator and about one fourth (25.7%) of tenants were involved in seed production. Regarding various types of seed production, survey results indicated seed of cereal crops were produced by 10.3% of farmers, vegetables by 2.8% farmers and both (cereal + vegetable) by 86.9% farmers. On an overall basis, 64.0% of the farmers reported their sale of seed produced on their farms. Outcomes indicated that on overall basis, 34% respondents were involved in multiplication of their own seed. However, these findings can be coincided with Srinivas *et al.* (2010) who reported that majority (53%) of farmers used/multiplied their own produced seed; and 20% obtained seed from other farmers.

**Table 4:** Sources of information about seed.

	Types of farming		
	Landlord / Own cultivator	Tenant	Overall
Agriculture Extension Wing	1.74	1.80	1.75
Agriculture Research Institute (ARI)	1.03	1.03	1.03
Balochistan Agriculture Research Centre	1.02	1.01	1.02
Federal Govt./FSC&RD	1.00	1.00	1.00
Neighboring Farmers	3.99	4.06	4.00
Seed Companies	2.10	2.03	2.05
Seed dealers	4.46	4.41	4.45
Agri. program on radio	1.01	1.01	1.01
Agri program on TV	1.00	1.00	1.00
Agri Literature	1.23	1.10	1.20
NGOs	1.64	1.20	1.55

1, not at all information; 2, little information; 3, reasonable quantity of information; 4, more information; 5, much information.

**Table 5:** Preparation and sale of seed.

		Landlord / Own cultivator		Tenant		Overall	
		Count	N (%)	Count	N (%)	Count	N (%)
Whether produce seed	Yes	107	36.9%	18	25.7%	125	34.7%
	No	183	63.1%	52	74.3%	235	65.3%
	Total	290	100.0%	70	100.0%	360	100.0%
Type of seed produced	Cereals only	11	10.3%	2	11.1%	13	10.4%
	Vegetables only	3	2.8%	1	5.6%	4	3.2%
	Both (Cereal + Vegetable)	93	86.9%	15	83.3%	108	86.4%
	Total	107	100.0%	18	100.0%	125	100.0%
Sale of treated seed	Yes	69	64.5%	11	61.1%	80	64.0%
	No	38	35.5%	7	38.9%	45	36.0%
	Total	107	100.0%	18	100.0%	125	100.0%

**Table 6:** *Experience of producing seed.*

	Landlord / Own cultivator	Tenant	Overall
N	107	18	125
Min	2	3	2
Max	15	10	15
Mean	6.19	6.61	6.25
SE	0.233	0.637	0.219

#### *Famers experience of producing seed*

Descriptive statistics of the respondents' experience related to seed production and multiplication on their own farm is unveiled in [Table 6](#). On an overall basis, the average experience of famers of producing seed was estimated at 6.25 years. Similarly, the tenants had 6.61 years of seed production experience, which was higher than the experience of landlord/owner cultivators of 6.19 years. Likewise, these results are in connection with [Win et al. \(2019\)](#) who reported that almost all farmers, 97.6%, had 1- to 5-years of seed production experience. Similarly, [Tirfe \(2014\)](#) also reported that the farmers experience for producing seed was 14 years, respectively.

#### *Sources of seed multiplication of seed*

[Table 7](#) shows survey data regarding source of basic seed for multiplication. On an overall basis, dealer (96.8%)

and neighboring farmer (88.8%) were observed to be the major sources of basic seed for multiplication. However, 36.8% of famers reported seed companies as their source of basic seed. Only 14% of the farmers reported that seed was purchased from Agriculture Department (Public Sector Organization). From this, it was inferred that private sector was more active in selling basic seed in comparison of public sector organizations. Similar type of research findings were recorded from the study of [Hussain et al. \(2017\)](#) whereby it was reported that only 20 to 25% of the farmers obtained seed from formal sources.

#### *Knowledge regarding maintaining seed quality*

Descriptive statistics regarding knowledge of maintaining seed quality has been presented in [Table 8](#). It was supervising that quite a large proportion (96.0%) of the farmers informed that they had information about seed treatment, but when asked names of fungicides, only one landlord could be able to pronounce one fungicide used as treatment of seed.

Regarding knowledge about maintaining seed quality, little less than half (49.6%) of the respondents replied "Yes." However, majority of the farmers had knowledge about maintaining moisture content in seed (93.6%) and knowledge about how to control pest during storage of seeds.

**Table 7:** *Source of basic /pre basic seed for multiplication.*

		Landlord / Own cultivator		Tenant		Total	
		Count	N (%)	Count	N (%)	Count	N (%)
Agriculture Department	Yes	15	14.0	3	16.7	18	14.4
	No	92	86.0	15	83.3	107	85.6
	Total	107	100.0	18	100.0	125	100.0
Seed Company	Yes	36	33.6	10	55.6	46	36.8
	No	71	66.4	8	44.4	79	63.2
	Total	107	100.0	18	100.0	125	100.0
Dealer	Yes	105	98.1	16	88.9	121	96.8
	No	2	1.9	2	11.1	4	3.2
	Total	107	100.0	18	100.0	125	100.0
NGO	Yes	10	9.3	0	.0	10	8.0
	No	97	90.7	18	100.0	115	92.0
	Total	107	100.0	18	100.0	125	100.0
Neighbor Farmer	Yes	96	89.7	15	83.3	111	88.8
	No	11	10.3	3	16.7	14	11.2
	Total	107	100.0	18	100.0	125	100.0

**Table 8:** Farmers' knowledge about seed quality.

		Landlord / Own cultivator		Tenant		Total	
		Count	N (%)	Count	N (%)	Count	N (%)
Information about seed treatment	Yes	103	96.3%	17	94.4%	120	96.0%
	No	4	3.7%	1	5.6%	5	4.0%
	Total	107	100.0%	18	100.0%	125	100.0%
Knowledge about fungicide treatment of seed	Vita Vex (% per Kg)	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Thorium (% per Kg)	0.0	0.0%	0.0	0.0%	0.0	0.0%
	Others (% per Kg)	1	0.9%	0.0	.0%	1	.8%
	Don't know	106	99.1%	18	100.0%	124	99.2%
	Total	107	100.0%	18	100.0%	125	100.0%
Know how to maintain seed quality	Yes	56	52.3%	6	33.3%	62	49.6%
	No	51	47.7%	12	66.7%	63	50.4%
	Total	107	100.0%	18	100.0%	125	100.0%
Know how to maintain moisture content in seed	Yes	102	95.3%	15	83.3%	117	93.6%
	No	5	4.7%	3	16.7%	8	6.4%
	Total	107	100.0%	18	100.0%	125	100.0%
Know how to control pest during storage of seed	Yes	74	69.2%	14	77.8%	88	70.4%
	No	33	30.8%	4	22.2%	37	29.6%
	Total	107	100.0%	18	100.0%	125	100.0%

**Table 9:** Sources of seed for wheat crop.

		Owner/Landlord		Tenant		Overall	
		Count	N (%)	Count	N (%)	Count	N (%)
Source of Seed	Informal	110	38.3	20	30.8	130	36.9
	Formal	93	32.4	29	44.6	122	34.7
	Both	84	29.3	16	24.6	100	28.4
	Total	287	100.0	65	100.0	352	100.0
Informal	Own	128	66.0	15	41.7	143	62.2
	Neighbor	62	32.0	15	41.7	77	33.5
	Others	4	2.1	6	16.7	10	4.3
	Total	194	100.0	36	100.0	230	100.0
Formal	Private	173	97.7	45	100.0	218	98.2
	Public	4	2.3	0	.0	4	1.8
	Total	177	100.0	45	100.0	222	100.0

Almost the same estimate was reported by Mekbib (2008) that 49.6% of the famers had knowledge about maintaining seed quality. Moreover, Bagum *et al.* (2003) reported that before storage, they computed moisture %age of seed using traditional methods. Also, Bishaw *et al.* (2010) reported that awareness about pesticides and modern grain-storage practices was relatively low, and only 44% and 66% of farmers had information, respectively.

#### Sources of seed of different crops

##### Wheat

Table 9 shows sources of seed for wheat crop. On an overall basis, 36.9% of the farmers used seed of informal sources and 34.7% of the farmers used seed

of formal sources while 28.4 of the farmers used seed of both sources. Majority (62.3%) of the farmers used own seed of wheat crop while 33.5% of the farmers used seed of fellow/neighboring farmers.

Similar findings were reported by Bishaw *et al.* (2010) who concluded from their studies that seed of wheat crop from informal sector was dominant since majority of the famers (58%) of seed from their own stock while 36% of farmers informed that seed of neighboring farmers were used. Contribution of farmers sector was very small since 9% farmers informed that seed was purchased from seed dealers while only 2% of the farmers informed that seed was collected from public sector seed corporation.

From this it was inferred that most of the seed requirement (>50%) especially wheat seed come from informal sectors of the country. Large majority of the farmers used their own reserved seed from the previous crops. One-third share of the farmers purchased seed from private seed sectors, and less than two % used seed purchased from Public Sector Seed Corporation.

#### Cotton

Table 10 shows source of seed for cotton crop. On an overall basis, quite a large majority (86.2%) of the farmers informed that seed of cotton was obtained from formal sources only. On the other hand, 11.5% of the farmers informed that seed of cotton was obtained from both sectors (public and private) while a small proportion (2.3%) of the farmers replied that seed was obtained from informal sector only (no formal sector). Segregated data by formal sector revealed that all the cotton seed was purchased from private sector (dear/company).

Manjunatha *et al.* (2013) discussed the increasing

trend of cotton seed supply by the private sector (companies). It was informed that during early 90s era, contribution of private seed companies was around 55% of total cotton seed consumption which increased to 80% during 2010 because of the liberal seed policies encouraging private seed business in the country. This showed that positive impact was recorded that all the cotton growers of the area were informed seed purchased from formal sectors (private/dealer/company).

#### Rice

Table 11 shows sources of seed of rice crop. The table shows that on an overall basis, majority (82.4%) of the farmers obtained seed from formal sources only while 9.8% of the farmers under this survey obtained seed from both sources (formal + informal). Thus, collective share of formal sources was recorded as (92.2%). No role of public sector was observed in supplying seed to farmers. However, 100% farmers replied that seed was obtained from private sector.

**Table 10:** Sources of seed for cotton crop.

Sources of seed		Owner/Landlord		Tenant		Overall	
		Count	N (%)	Count	N (%)	Count	N (%)
Sources of seed	Informal	3	3.8	0	.0	3	2.3
	Formal	64	82.1	48	92.3	112	86.2
	Both	11	14.1	4	7.7	15	11.5
	Total	78	100.0	52	100.0	130	100.0
Informal	Own	7	50.0	1	25.0	8	44.4
	Neighbor	7	50.0	3	75.0	10	55.6
	Landlord	0	0	0	0	0	0
	Total	14	100.0	4	100.0	18	100.0
Formal	Private	75	100.0	52	100.0	127	100.0
	Public	0	0	0	0	0	0
	Total	75	100.0	52	100.0	127	100.0

**Table 11:** Sources of seed of rice crop.

Sources of seed		Owner/Landlord		Tenant		Overall	
		Count	N (%)	Count	N (%)	Count	N (%)
Sources of seed	Informal	2	5.3	2	15.4	4	7.8
	Formal	31	81.6	11	84.6	42	82.4
	Both	5	13.2	0	.0	5	9.8
	Total	38	100.0	13	100.0	51	100.0
Informal Sources	Own	5	71.4	0	0	5	55.6
	Neighbor	2	28.6	2	100.0	4	44.4
	Landlord	0	0	0	0	0	0
	Total	7	100.0	2	100.0	9	100.0
Formal Sources	Private	36	100.0	11	100.0	47	100.0
	Public	0	0	0	0	0	0
	Total	36	100.0	11	100.0	47	100.0



**Table 12:** Sources of seed for onion crop.

		Owner/Landlord		Tenant		Overall	
		Count	N (%)	Count	N (%)	Count	N (%)
Sources of Seed	Informal	86	51.2	15	34.1	101	47.6
	Formal	49	29.2	27	61.4	76	35.8
	Both	33	19.6	2	4.5	35	16.5
	Total	168	100.0	44	100.0	212	100.0
Informal Sources of seed	Own	61	51.3	5	29.4	66	48.5
	Neighbor	56	47.1	7	41.2	63	46.3
	Others	2	1.7	5	29.4	7	5.1
	Total	119	100.0	17	100.0	136	100.0
Formal Sources of Seed	Private	82	100.0	29	100.0	111	100.0
	Public	0	0	0	0	0	0
	Total	82	100.0	29	100.0	111	100.0

**Table 13:** Sources of seed for tomato crop.

		Owner/Landlord		Tenant		Overall	
		Count	N (%)	Count	N (%)	Count	N (%)
Sources of Seed	Informal	1	0.5	0	0	1	0.4
	Formal	218	98.2	56	94.9	274	97.5
	Both	3	1.4	3	5.1	6	2.1
	Total	222	100.0	59	100.0	281	100.0
Sources of informal seed	Own	0	0	0	0	0	0
	Neighbor	3	100.0	3	100.0	6	100.0
	Landlord	0	0	0	0	0	0
	Total	3	100.0	3	100.0	6	100.0
Sources of formal seed	Private	222	100.0	59	100.0	281	100.0
	Public	0	0	0	0	0	0
	Total	222	100.0	59	100.0	281	100.0

Similar findings were also recorded from the study conducted by [Spielman et al. \(2014\)](#) and [Manjunatha et al. \(2013\)](#) who reported that more than 75 % of growers purchased rice seed from private sector sources.

#### Onion

[Table 12](#) reveals source of seed of onion crop. On an overall basis, 47.6% of the farmers informed that seed was obtained from informal source only while 35.8% of the farmers informed that seed was obtained from formal sources while 16.5% of the farmers reported that seed was obtained from both sources (formal and informal). Like other crops, private sector was acknowledged for supplying seed by all the farmers (100%). Data regarding informal sources of seed revealed that little less than half (48.5%) of the farmers used their own seed for cultivation of onion crop. Likewise, findings were also reported by [Hassan et al.](#)

(2008) indicating that about half the farmers (49%) used their own seeds saved from the previous season and 37% of them purchased seed from neighbors.

#### Tomato

[Table 13](#) presents summarized data regarding sources of seed of tomato crop. Overwhelming majority of the farmers informed that seed was obtained from formal sources. Among formal sources, private sector i.e. seed dealer or seed companies were dominant as reported by all the farmers (100%) under this survey. Similar findings were also reported by [Iqbal and Toufique \(2016\)](#) reported that almost all the farmers who grow cauliflower and maize are found to use formal seeds only. Farmers are more likely to depend only on formal seeds in the case of jute (91%), tomato (88%), onion (87%), potato (73%), and sugarcane (70%).

**Table 14:** *Farmers' problems regarding access to quality seed.*

		Owner/Landlord		Tenant		Overall	
		Count	N (%)	Count	N (%)	Count	N (%)
Wheat	Available	200	68.97	43	61.43	243	67.50
	Affordable	180	62.07	38	54.29	218	60.56
	Good quality	125	43.10	33	47.14	158	43.89
Cotton	Available	240	82.76	65	92.86	305	84.72
	Affordable	175	60.34	30	42.86	205	56.94
	Good quality	88	30.34	20	28.57	108	30.00
Rice	Available	239	82.41	61	87.14	300	83.33
	Affordable	178	61.38	42	60.00	220	61.11
	Good quality	165	56.90	37	52.86	202	56.11
Onion	Available	85	29.31	44	62.86	129	35.83
	Affordable	70	24.14	14	20.00	84	23.33
	Good quality	68	23.45	14	20.00	82	22.78
Tomato	Available	284	97.93	66	94.29	350	97.22
	Affordable	60	20.69	11	15.71	71	19.72
	Good quality	63	21.72	15	21.43	78	21.67

#### *Farmers' problems regarding access to quality seed*

**Table 14** presents data of farmers problems regarding access to quality seed. Three questions regarding availability, affordability, and good quality was asked about the common crops grown *i.e.* wheat, cotton, rice, onion and tomato. It was observed that the major problem of the farmers to access to quality seed was recorded as affordability and good quality. On an overall basis, 67% of the farmers informed that wheat seed is available, 60% informed that seed is affordable while small proportion of the farmers informed that good quality of wheat seed is available in the market.

Regarding cotton seed, 56% of the farmers were of the opinion that seed is affordable while again a small proportion (30%) of the farmers were not satisfied with the quality of the seed. Proportion of dissatisfaction with the quality of the seed supplied was very low, computed as 22.78% of the farmers for onion seed and 21.67% for farmers.

[Patil et al. \(2005\)](#) divulged that majority (55 %) had opined that the seeds supplied by the public sector were reasonably priced. Similarly, [GoP \(2008\)](#) reported that 59.3% farmers considered that the seed available in the market is of inferior quality and thus affect the farm productivity. Since, [Ray et al. \(2001\)](#) reported that lack of quality seed (39%) and non-existence of quality control are the major hurdles of agricultural development.

#### **Conclusions and Recommendations**

Major findings of the study revealed that quality seed for the production of various crops is the major concern of the growers of Balochistan. Although seed was purchased from formal sources (seed companies and dealers), majority of the growers expressed their concerns regarding poor quality of seed. By the same token, it was reported by the majority of the respondents that seed was not affordable. Role of public sector organizations (Agriculture Department) was minimal in supply of quality seed to the farmers. Based upon research findings, the following recommendations were developed for public and private sector organizations for quality supply of seed to the farmers of Balochistan: (i) Public sector may take initiatives for increasing and distribution of quality seed; (ii) Provincial agriculture extension department may take efforts to get the seed dealers registered; (iii) Extension education programs may be initiated for seed production; (iv) Seed dealers should be given training to seed dealers especially in maintaining seed of vegetables since farmers reported that seed dealers were the major source of vegetable seed; (v) Extension education programs maybe initiated for farmers and dealers regarding maintaining the quality of seed *e.g.* maintaining moisture content, seed treatment, seed grading, *etc.*; (vi) The agriculture extension department and FSC&RD may arrange training regarding seed Act 1976 (Seed Amendment Act, 2015); (vii) Public

Sector Institutes (Agriculture Extension) should be more active to provide agricultural information especially inputs to farmers. Relatively more information is provided by the private sector but the goal of the seed companies is to sale their company products (seed varieties) rather than increasing productivity/profitability of famers produce; (viii) Agriculture Extension department may also be involved in seed monitoring and evaluation by Federal Seed Certification and Registration; (ix) Balochistan Seed Corporations may be established and for its effective role the model (working pattern) of Punjab Seed Corporation may be adopted; and (x) Provincial government have large size of research farm-lands, these lands may be allotted to seed companies/ progressive farmers according to agriculture policy for production and multiplication of seed.

## Novelty Statement

This study work is inimitable in the sense that type of comprehensive research has not been conducted in Pakistan regarding source of basic seed for multiplication and production of field and vegetable crops in Balochistan province of Pakistan.

## Authors' Contribution

Shahinshah Khan conducted research work, collected and analyzed the data and developed research paper. Aijaz Ali Khooharo supervised the whole study process and research work. Zaheeruddin Mirani was involved in field survey report writing and editing. Velo Suthar supervised the data analysis.

## Conflict of interest

The authors have declared no conflict of interest

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