

## **An Investigation into Crops Improved Seed Availability, Snags and Future Prospect for Pakistan**

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**Abstract:** Agriculture is the mainstay of Pakistan's economy with 21% contribution to national gross domestic product. Seed is an important component in agricultural productivity. Seed is sexually produced matured ovule consisting of an intact embryo, endosperm and or cotyledon with protective covering called seed coat. Quality seed is the most desirable input for improving yield. Timely availability of seed ensures food security and prosperity of farmers. Seed holds the vital position to bridge the gap existing in average crop yields and potential of available varieties. Seed is a high technology product and is an innovation most readily adapted. Improving access to good quality seed is a critical requirement for sustainable agricultural growth and food security. In Pakistan, farmers use their farm-saved seed of almost all crops and other few who dare to purchase new varieties are not aware of the credentials of improved seed and markets are also infested with seed of unknown genetic resource which are mostly imported and are not tested for local soil and climatic conditions along with being physically and genetically impure. There is a need to initiate a problem oriented breeding program and it should follow a vast and comprehensive extension program to make the farmers aware of modern production technology.

**Key words:** Certified seed • Hybrid seed • Imported seed • Sexual propagation • Seed adulteration

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### **INTRODUCTION**

Despite structural shift towards industrialization, agriculture sector continues to remain the mainstay of Pakistan's economy with deep effects on socio-economic setup. Agriculture generates productive employment opportunities for 45 percent of the country's labor force and 60 percent of the rural population depends upon this sector for its livelihood [1]. It has a vital role in ensuring food security, generating overall economic growth, reducing poverty and the transforming towards industrialization. The foremost objective of Agriculture sector in Pakistan is to ensure adequate production and availability of food for the population and it provides livelihood to people directly involved in the sector along with the value adding chain. The attainment of sustainable growth in agriculture sector fulfills macroeconomic objectives through its forward and backward linkages with the other sectors. Accelerated agricultural growth directly helps in redistribution of poverty and provides the farmers a required level of

nutritious food. The prosperity of a large fragment of community revolves around agriculture that requires timely and adequate inputs, ensures better environment for sustainable economic growth. The change in consumption pattern with a change in per capita income level requires more proteins containing diet. But matter of fact is that agricultural productivity in Pakistan is much less as compared to other countries including of crops like wheat, rice, sugarcane, maize, oil seed crops and forages. A variety of soil related, climate related and agronomy related factors hamper the attainment of higher crops yield. But the use of crop varieties with low yield potential as well as physically and genetically impure seed causes a significant reduction in crops yield. Quality seed is the most desirable input for improving yield. Seed is an important component in agricultural productivity system. Seed is sexually produced matured ovule consisting of an intact embryo, endosperm and or cotyledon with protective covering (seed coat). It also refers to propagating materials of healthy seedlings, tuber, bulbs, rhizome, roots, cuttings, setts, slips, all types of grafts and

vegetative propagating materials used for production purpose [2]. Basically a seed is made of embryo, endosperm and a protective covering called seed coat or testa. Timely availability of seed ensures food security and prosperity of farmers. Seed holds the important position to bridge the gap existing in average crop yields and potential of available varieties. Seed is a high technology product and is an innovation most readily adapted [3]. Improving access to good quality seed is a critical requirement for sustainable agricultural growth and food security [4 & 5]. Effective use of improved/certified seed can result in higher agricultural production and increases the net incomes of farming families which has a positive impact on rural development. It is worth mentioning that mostly small farmers use their farm-saved seeds over the years, despite the fact that after each year this farm-saved seed results in substantial yield reduction. In any year, if a crop confronts drought at some critical stage then it results in smaller grains production and next year the use of this seed is bound to cause yield reduction in the range of 16-40% [6-11]. To make the matter from bad to worse, use of unimproved crop varieties of unknown genetic resource base also cause reduction in crops production. In Pakistan, farmers use their farm-saved seed of almost all crops year after and other few who dare to purchase new varieties are not aware of the credentials of improved seed and markets are also infested with seed of unknown genetic resource which are mostly imported and are not tested for local soil and climatic conditions along with being physically and genetically impure.

This study provides an overview of improved seed availability of agricultural crops, snags in production and use of improved seed by farming community as well as future prospect of improved seed availability and use in Pakistan.

#### **MATERIALS AND METHODS**

In this study, the data pertaining to the cultivated area, number of seed companies and availability of quality seed of major and minor crops were collected from Economic survey of Pakistan [1], Food and Agriculture Organization [12, 13], Ministry of National Food Security and Research [14], Punjab Development Statistics [15] and different related scientific articles. Interviews with farmers, wholesalers and retailers were conducted purposively during April 2014 to September 2014.

#### **RESULTS AND DISCUSSION**

**Essence of Quality Seed:** The quality of seed represents all those attributes that contribute to seed germination and effect the overall seed performance. The purest seed of a particular variety developed by a breeder of particular research station or institute is called as nucleus seed or breeder seed. This type of seed is obtained from selected individual plants of a particular variety and then purified and multiplied in such a way to maintain its genetic purity. This seed type is not certified by federal seed certification and registration department (FSC&RD), despite the fact breeder seed provides the base for breeding and seed multiplication and production programs. The progeny of breeder seed is of the highest genetic purity produced by respective research station and is called pre-basic seed and is labeled with white color label having diagonal lines of violent color issued by FSC&RD. The progeny of pre-basic seed produced by an organization setup by provincial government is called basic seed and has white color labels. The progeny of basic seed produced by registered growers of seed producing agency and with blue color label is called certified seed. Seed true to species as approved by FSC&RD and with yellow color labels, is called approved seed. The imported seed that has been tested under truth in labeling rules, 1991 having pick color labels is called truthfully labeled seed. Seed quality is the sum total of all attributes that determine and contribute to seed performance. The first and foremost attribute of quality seed is genetic purity as breeder/nucleus seed (100%) pure, certified seeds varieties (98%), certified hybrid seed (95%) and certified hybrid cotton seed (90%). Physical purity is also an important attribute of seed quality as all agronomic crops seed needs to be 98% pure physically and vegetable crops seed need to be 95% pure physically. Optimum moisture content is an important seed quality attribute and recommended seed moisture content of different crops include cereals (10-12%), pulses (7-9%), oilseeds (6-7%) and vegetables (5-6%). Quality seed should have high germination percentage and free from seed borne diseases like loose smut of wheat, kernel smut of sorghum and grain smut of pearl millet. It should have high seed vigor which is the emergence and development of normal seedling and is an indication of ability of a seed to produce healthy and productive plants under a wide range of field conditions and is measured by speed of germination and rate of seedling growth.

Table 1: Number of registered public, private and multinational seed companies in Pakistan

Ownership	Punjab	Sindh	Baluchistan	KPK	G.B	Total
Public	01	01	01	01	-	05
National Private	600	91	07	20	02	720
Multi-national private	04	01	-	-	-	05
Total Active	605	93	08	21	02	729

**Seed Industry Status:** In Pakistan, both public and private sector contribute to agricultural sector by providing improved seed of all major crops. The private sector was allowed to enter seed business in 1979. In 1994 the Government declared seed business at par with the other industries. As a result of this policy a wave of investments was generated. In 1976 there were just a handful of seed companies in public sector and four seed processing plants were installed with an annual capacity of one million tons for crops like wheat, rice, maize and cotton. By 2001, about 143 seed processing plants were installed with an investment of Rs.819 million to process 4.75 million tons seed. By 2010, many fold increase in production capacity has taken place depicting the tremendous investment that private sector is willing to bring into the seed sector. Table 1 indicated that there were 750 seed companies in Pakistan and Punjab province hosted the maximum number of companies and there were four public sector seed companies and five multinational companies. Pakistan follows a strict variety approval procedure to ensure quality. Selection of best performing strains by the plant breeder in Micro-Varietal Trials is done and then performance and Adaptability testing is conducted through zonal varietal trails. National uniform yield trials are conducted by concerned national crop coordinator. After receiving the application for approval of a variety, spot examination, evaluation for performance, quality and resistance is conducted by technical expert sub-committees, which give suggestions to provincial seed councils for approval or rejection of the variety and then respective provincial seed councils approve the variety. National seed council finally notifies the variety as released or approved. Registration of the variety is done by federal seed certification and registration department on the basis of recommendations by Pakistan Agricultural Research Council after tests conducted for at least two consecutive seasons. The maximum number of registered varieties was of wheat crop that were 134 and it was followed by cotton as there was 109 varieties registered by federal seed certification and registration department (FSC&RD). The number of registered varieties of sugarcane, rice, maize and barley were 39, 35, 25 and 10 respectively. The number of registered varieties of fodders, oilseed crop and pulses were 37, 60 and 72,

respectively, while vegetables and fruits have the registered varieties of 57 and 35, respectively up to 2012 (Fig. 1). Currently in Pakistan, there are more than 720 registered seed companies that are providing quality seed of all major and minor crops to farmers. There are five public seed companies one in four provinces each. There are about 600 private national seed companies in Punjab province and it is followed by Sindh province where there are about 79 national private seed companies (Table 1). Multinational seed companies have also entered in seed business and currently five multinational seed companies are providing seeds of major and minor crops. These multinational seed companies include Monsanto, Pioneer, ICI, Syngenta and Bayer. Four of these multinational seed companies are based in Punjab and one is working in Sindh. Every year, the highest cropping area comes under wheat crop as there was about nine million hectares under wheat crop in 2012-13 and the quantity of approved seed for over 9 million hectares was just over 0.25 million tons against the requirement of over one million ton (Table 2). Thus for wheat which is the staple food of Pakistan, there was only one fourth of the requirement of approved seed was available in 2012-13. Cotton was cultivated on an area of 3.2 hectares in 2012-13 with total seed requirement of 40000 tons, while the availability of approved seed was over and above of the requirement because the most of private seed companies are dealing in cotton seed business in Pakistan and availability of seed is more than the requirement. Rice is also an important crop of Pakistan and earns foreign exchange by exporting rice to other countries. The area under rice was 2.7 million hectares in 2012-13 with total seed requirement of 42000 tons, but the availability of approved seed from both public and private sectors was just over 34500 tons making a net deficiency of about 8000 tons of both fine and course rice, even after imports of about 7700 tons. Similarly maize was grown on an area of ne million hectares and approved seed availability was only over 12000 tons, of which there was 10000 imported seed against the requirement of 32000 tons, thus maize is the single largest crop whose seed is being imported in the largest quantity. Like other major crops, fodders, oil seed crops and pulses seed are available in much less quantities than the requirement and farmers use their farm-saved seed of unknown genetic

Table 2: Area under different crops, total seed requirement and availability of approved seed from public, private and imports

Crop	Area (million hectares)	Total seed requirement (tons)	Seed availability (public) tons	Seed availability (private) tons	Imports (tons)	Total Availability (tons)
Wheat	9.045	1085400	72111	187779	-	259902
Cotton	3.2	40000	800	38000	-	46000
Rice	2.7	42480	4862	21951	7715	34528
Maize	1.063	31914	312	1521	10715	12548
Pulses	1.33	47495	339	889	-	1228
Oilseeds	0.829	10582	62	128	1065	1256
Fodders	1.92	40137	11	-	13314	13325
Vegetables	0.253	5070	21	296	5135	5453

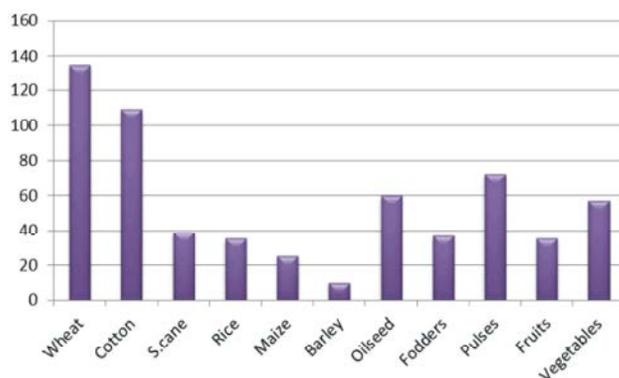


Fig. 1: Number of approved varieties of major and minor crops, registered by federal seed certification and registration department

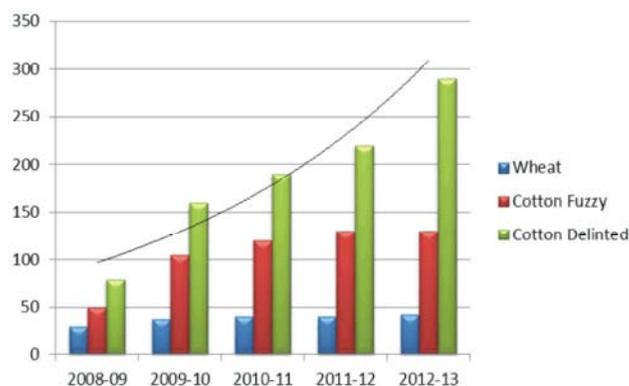


Fig. 2: Per kilogram price of approved wheat, cotton fuzzy seed and delinted cotton seed

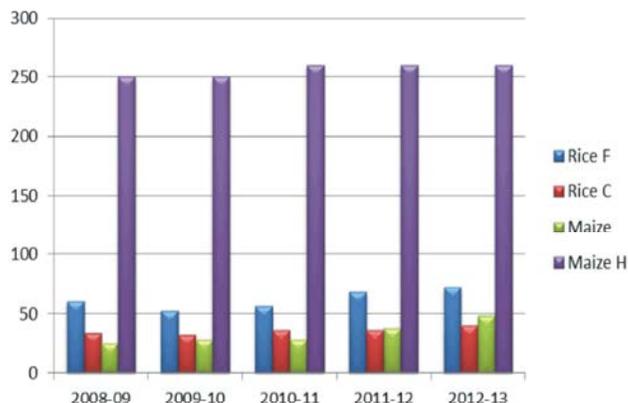


Fig. 3: Per kilogram price of approved fine rice, course rice, maize and hybrid maize seed

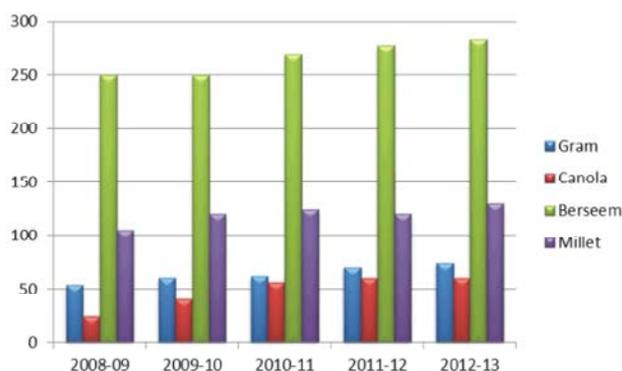


Fig. 4: Per kilogram price of approved gram, canola, berseem and millets seed

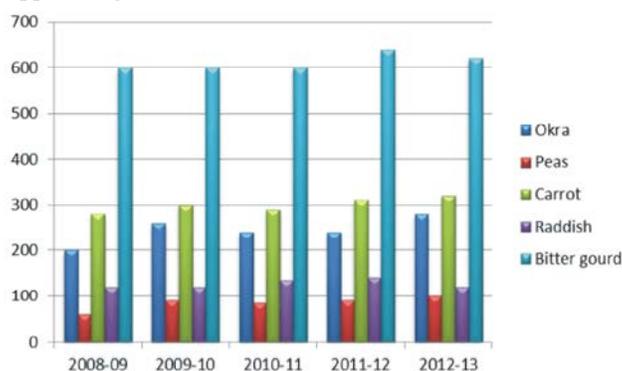


Fig. 5: Per kilogram price of different vegetables seed of approved varieties

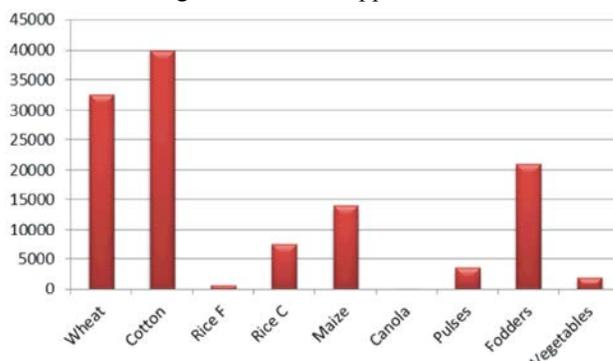


Fig. 6: Potential seed market of different crops and vegetables in million rupees

potential year after year which results in significant yield loss. Economics of approved seed plays an important role in adoption and price of approved seed becomes even more important factor in a country like Pakistan where majority of the farmers are small land holders and survive on credit facilities provided by different commission agents. Per kilogram price of approved seed of wheat in 2012-13 was Rs.42 and that of delinted cotton seed was in the range of Rs.280-300 kg<sup>-1</sup> (Fig. 2). Hybrid maize seed was sold at the price of just over Rs.250 kg<sup>-1</sup> and that of conventional cross pollinated maize forage was Rs.50 kg<sup>-1</sup> (Fig. 3). Per kilogram prices of approved seeds of canola,

berseem and millet were Rs.60, 250 and 140, respectively in 2012-13 (Fig. 4). Vegetables seed prices are also given in Fig. 5. Fig. 6 depicts the potential seed market of Pakistan as only wheat seed price fall in the amount Rs.32000 million calculated on the basis of total wheat seed requirement, while cotton seed represents the biggest market in terms of money and investment involved which is about Rs.40000 million. Fodder seed market represents the investment potential of Rs.22000 million. Thus approved seed market holds huge potential as we have been unable to provide the approved seed of even major crops like wheat, rice and maize.

### **Snags In Production And Use Of Crops Approved Seed:**

It is a matter of grave concern that despite being an agrarian economy, the farming community in Pakistan has not realized the true importance of good quality seed in obtaining the sustainable and economic yield of all major and minor crops. This lack of knowledge about the importance of quality seed constitutes the biggest hurdle in the use of approved seed of crops. In an agrarian community, particularly in Pakistan where majority of the farmers are small land holders, every thing revolves around economics. The prices of approved varieties are fairly high and debt-ridden farmers are not in a position to purchase newly released or approved varieties and prefer to sow their farm-saved seed or take it from companion farmers at nominal prices. Farmers are not aware of modern production technology, so they are unable to achieve the full potential of approved seed and continue to consider their farm-saved seed at par with approved seed. Farm inputs like fertilizers, pesticides and irrigation are not given their due importance which undermines the performance of approved seed and farmers blame approved seed and consider it only a waste of money. Substandard seed that is being sold in local markets has strtrained the image of new and approved seed as markets are infested with substandard seed that does not ensure the required physical and genetic purity. There are variety of snags which are related to supply side such as private national seed companies are the biggest stakeholder in seed market, but are not regulated and there is no strict check and balance on these companies and farmers repeatedly complain about the poor quality of seed provided by different local companies at substantially high price, which has distracted farmers from benefits associated with quality seed. Another important hurdle related to supply side is that there are no attractive incentives for researchers to develop new varieties that are suitable for local soil and climatic conditions. Research Institutes in Pakistan depict the picture of helpless statues as these are understaffed as well as face severe paucity of funds which hampers the development of research work on vertical development programme. Foreexample, upto now, we have not been able to develop cotton varieties that are resistant to heat and do not shed flowers during severe heat months of summer. Furthermore, research is not field oriented in Pakistan and farmers are not given solutions according to their problems in the form of improved varieties and resultantly farmers have not been attracted towards the use of approved seed. A small proportion of farmers who want to purchase the seed of

approved varieties only find it hard as it is not easily in their approach due to the absence of any research institute or franchise of registered seed company.

**Recommendations:** In order to make the seed of approved varieties an integral component of farming system, there is a need to overcome both supply related as well as demand related hurdles that have hampered the use of quality seed on large scale. First and foremost thing that needs to be done is that all research related to variety development must be given new direction to make it field oriented as well as problem oriented. The emerging water scenario and global warming have raised the importance of drought resistant as well as heat resistant varieties and such developed varieties are bound to attract farmers with ease and comfort. For instance, any new wheat variety requiring only two or three irrigations without compromising the economic yield will hold more potential to be adopted earlier in arid as well as irrigated areas. A problem oriented breeding program is the need of hour and government needs to shoulder the responsibility by providing funds for basic infrastructure as well as for hiring technical experts. The breeders should be given incentives to work on development of new varieties with more yield potential and once developed, again government should provide seed to farmers on subsidized rate as farmers are not financially sound enough to purchase the approved varieties seed of both kharif and rabi crops. The provincial agriculture departments should be given responsibility to educate the farmers regarding crops production technology and for this demonstration plots of newly approved varieties will go a long way in making the adoption of approved varieties on large scale. Farmers should be provided seed of newly developed varieties in small quantity and allowing them to multiply it and after a year they will be self-sufficient in a new variety as being done in India. Farming community must be made aware of the fact that full potential of seed can only be achieved with adoption of modern production technology only. They should be made to realize that only a judicious use of fertilizers, irrigation and insect pest management in combination can realize the actual seed potential. There is a need to formulate a task force to formulate stringent laws regarding seed standards and companies compromising seed quality must face with cancellation of license and there should be continuous seed testing by provincial agriculture departments regarding physical and genetic purity as well as germination.

## CONCLUSION

Seed is one of the most important farm input and its quality plays a key role in final yield. Farmers use their farm-saved seed year after year and resultantly its potential decreases. Lack of awareness and high prices of newly developed varieties have also hampered their adoption. There is a need to initiate a problem-oriented breeding program and it should follow a vast and comprehensive extension program to make the farmers aware of modern production technology. There is a need of strict laws regarding seed adulteration and such companies must be thrown out of market and a continuous vigil by provincial agriculture departments related to seed quality will ensure quality seed adoption as an integral component of farming system.

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