



## INDIAN VEGETABLE SEEDS INDUSTRY: STATUS AND CHALLENGES

A V VKoundinya and P Pradeep Kumar

Department of Vegetable Crops, BCKV, Mohanpur, Nadia, W.B.

Email: [pradeephortico@gmail.com](mailto:pradeephortico@gmail.com) Ph: 8274995417

**ABSTRACT:** Seed is the first and foremost important commodity for successful vegetable cultivation. Indian vegetable seed industry is going enormously annually. The policies of Govt. of India since independence liberalized and encouraged the seed trade in India. Several private seed firms with multinational base are actively involving in vegetable seed production in India making the public sector much lagging behind. Expanding areas under vegetable cultivation, varied agro-climatic conditions, availability of huge and cheap human resource are creating titanic scope for development of vegetable seed industry in India. Vegetable seed industry has positive influence on Indian economy in terms of income and employment generation and earning foreign exchange in international market. There are few constraints like high cost of seed production, technical problems and stringent laws set break to the vegetable seed industry in India.

**Key words:** Vegetable, Seeds industry, Scope and Importance.

### INTRODUCTION

Seed is a key component among all inputs for sustainable crop production. It is estimated that quality of seed accounts for 20-25% of productivity [1]. The importance of quality seed has been realized by mankind long ago. The need for a good viable seed for prosperity of human race is mentioned in *Rigveda* of ancient India. It is mentioned in the primeval *manusmriti* as “*Subeejam Sukshetre Jayate Sampadyate*” [11] which literally means “A good seed in a good field will win and prosper”. Saving of some portion of produce as seed for next cropping season or year in various structures is a very common and age old practice of Indian farming community. Albeit there have been few private seed industries dealing with production of vegetable seeds, the growing of crops especially for seeds in an organized fashion to maintain quality in terms of genetic and physical purity is realized for first time during green revolution period with the establishment of National Seeds Corporation (NSC) in 1963 [11, 3]. It is setup by aiming at promoting healthy development of seed industry in India. The principle responsibilities of NSC are establishing an adequate system of quality control inspection for scientific processing, storage and marketing of seeds. It also undertakes the responsibility of multiplication of seed of pre released varieties and production of foundation seed of varieties. Few mile stone events in seed policy by Govt. of India are described below.

#### The Seeds Act, 1963

The Seeds Act is formulated in 1963 and has come into force in 1966 [11]. The important features of this act are: Seeds should contain specific seed standards, which include stipulated minimum physical and genetic purity, percentage germination [3] and not exceeding the maximum permissible off types and weed seeds. The seeds should be tagged either by compulsory labeling or voluntary certification [3, 11]. Further, the Act provides a system for seed quality control through independent State Seed Certification Agencies which were placed under the control of state departments of agriculture [3].

#### National Seeds Project

The National Seeds Projects were implemented in three phases viz., Phase I (1975), Phase II (1981) and Phase III (1988) with funds obtained from World Bank [1,3]. Under these projects initially nine State Seed Corporations which were later increased to 13 and now 15, State Seed Certification Agencies, State Seed Testing Laboratories were established and programmed like Breeder Seed Programmed were under taken [1, 3].

**NewSeeds Policy, 1988**

This policy made a revolution in Indian seed industry by liberalizing the seed trade [3]. This policy made Indian farmers to access best quality seed or planting material from any part of the world [11]. Under this policy Foreign Direct Investments are allowed and encouraged as a result several multinational seed companies entered into seed business in India and several Indian private seed companies are welcomed into huge seed trade. Seed production is considered as one of “High Priority Industries” under this policy [3,9]. This policy has also liberalized the import of improved varieties and breeding lines and import of vegetable and flower seed in general and seeds of other crops based on some restrictions through open general license and removed tariff barriers [9]. This has resulted in import of hybrid seeds in cabbage, cauliflower, chillies, etc. besides large quantities of seeds of carrot and beetroot by private seed companies.

**PPV & FRA, 2001**

Protection of Plant Varieties and Farmers Rights Act, 2001 provides farmers the right to save, use exchange, share and sell farm produce of protected variety except sale of branded seed. The farmers are also protected against the unscrupulous seed companies that provide spurious seeds or planting material by declaring the expected performance of a variety. It is envisaged that the breeders are expected to disclose to the farmers at the time of sale of seed or propagating material about the potential of the variety sold. So that the farmer or group of farmers can claim compensation if it is failed to give specified performance under given conditions as specified by the breeder of the variety [12].

**The Seeds Bill, 2004**

The Seeds Bill, 2004 has been enacted to overcome the limitation of the Seeds Act, 1966 and for the regulation of seed quality and planting material of all agricultural, horticultural and plantation crops with the view to ensure availability of true to type seeds to Indian farmers, curb sale of spurious and poor quality seeds, increase in private participation in seed production, distribution and seed testing and liberalization of imports of seeds and planting material [1].

**Current status**

Indian seed industry has been growing awfully in quantity and value over the past fifty years. Both public and private sector corporations/companies are actively involving in quality seed production. The public sector component comprises National Seeds Corporation (NSC), State Farm Corporation of India (SFCI) and 15 State Seeds Corporations (SSCs) [3,11], Indian Council of Agricultural Research (ICAR) institutions and State Agricultural Universities. ICAR launched an All India Coordinated Research Improvement project (AICRP) on seed production called National Seed Project in 1979 with 14 centres in different Agricultural Universities [11]. AICRP on production of breeder seed in vegetable crops is started under National Seed Project in 1994. Twenty two State Seed Certification Agencies and 104 State Seed Testing Laboratories are involving in quality control and certification [11]. The private sector comprises around 150 seed companies of national and foreign origin but only few companies like M/S BejoSheetal, Indo-American Hybrid Seeds and Namdhari Seeds are working exclusively on vegetable hybrids [9].

The Indian public sector seed industry used to dominate the private sector in the very beginning. The order of type of seeds dominating the market in terms of quantity and value has been open-pollinated varieties followed by public hybrids and private hybrids [3]. The situation is quite reversed currently. Seeds of the private hybrids are forming a significant portion of the total vegetable seed market. The availability of vegetable seeds with NSC as on 30.09.2013 is 133.43 t of which 131.68 t of varietal seeds and only 1.75 t of hybrid seeds. Due to advent of private seed companies with the liberalization of seed trade in 1988, the public sector seed corporations/companies have started declining and becoming inept. Now a day the public sector is mostly confined to certified seeds of high volume, low value segment of high yielding varieties of cereals, pulses and cotton with a limited presence in the high value hybrid sectors of cotton and cereals [3, 9].

In vegetables most of the public sector varieties and hybrids are replaced by private sector varieties and hybrids, seed production of which is solely done by the particular manufacturers. Corporate seed firms are mainly concentrating on vegetables like tomato, cabbage, brinjal, chilli, okra and cucurbits where the seed production of OPVs and hybrids is comparatively easy and more profitable. The doable explanation for moribund of public sector can be incapability to generate huge funds on research and development (R&D) when compared to private seed companies and lack of proper advertisement and market for public sector bred varieties and hybrids. Private seed corporations are spending 10-12% of their turnover in R&D. Medium sized seed companies annual investment in R&D is growing 20% annually [1,3].

The gargantuan seed manufacturers with multinational base can assemble germplasm from any part of the world which cannot be done by the public sector institutions in easy way. As germplasm serves invaluable resource for any crop improvement programme, this makes the big difference. Moreover, these mega seed giants employ paramount technical personnel with opulence and extravagance, which can never be done by the public sector institutions.

At present Indian seed industry is the fifth largest seed market in the world accounting for 4.4% global seed market after US, China, France and Brazil. Indian seed market has grown at 12% rate where the growth rate of global seed market is 5% [16] while the Indian vegetable seed market is growing at a rate of 10-15% in a year. There has been an increase of 194% in Indian vegetable hybrid seed market during 1998-2008 [9]. The estimated turnover of Indian seed industry (50000m INR) is four percent of the global seed turnover (1250000 m INR) [9]. The vegetable seed business in India, at present, amounts for 9000 million INR accounting for 18% value wise share of different crops in Indian seed business [9]. In future, according to National Seed Association of India (NSAI), the size of Indian seed market is expected to grow at a rate of 11% p.a. to \$3.2bn till FY16 on account of favorable global grain supply demand fundamentals, grain productivity well below world's major grain producing regions and government's continued focus on improving seed replacement rate.

## **Factors promoting vegetable seed industry in India**

### **1) Ever Increasing Demand**

The worldwide production of vegetables has doubled over the past quarter century and the value of global trade in vegetables now exceeds that of cereals. India is emerging as the second largest producer of vegetables (17.3 t/ha) after China (22.5 t/ha). In the past two decades, the vegetable production in India has been increased 2.5 times from 58.5 mt in 1991-92 to 146.5 mt in 2010-11 [8]. Increase in yield is mainly attributed to expanding areas under high yielding vegetable varieties and hybrids. Total cultivated area under vegetables has been increased from 5.59 mha in 1991-92 to 8.49 mha in 2010-11 [8]. Finally, it leads to ever increasing demand for the quality vegetable seed. Moreover, the yield of crops are higher when produced from and replaced seeds than own saved seeds (Table-1). Seed replacement rates are high for vegetables like cabbage (100%), tomato (99.3%) compared to other cereals and oil seeds [10]. Total quantity of vegetable seeds produced in the country is not sufficient to meet the country's ever increasing demand. Currently quality seeds are met to the extent of 20% only. Farmers themselves meet the 75% through own saved seeds [11]. India is still importing the vegetable seeds from other countries major being radish followed by cabbage and pea [15]. India has imported 1525.38 t vegetables seed valuing 1503.1 m INR in the year 2007-08 (Table 2) [15].

### **2) Varied Agro Climatic Conditions**

India is blessed with assorted agro climatic conditions ranging from tropical to temperate which make possible the cultivation and seed production of all most all vegetables belonging to different temperature regimes. Seed production of warm season vegetables is possible in Indian plains and Deccan Plateau and seed production of winter vegetables like cabbage, cauliflower, broccoli, beetroot, European carrot and radish is possible in hill stations of Himalayan range. Some winter vegetables like Onion, Asiatic Carrot, Asiatic Radish and tropical cauliflower produce seeds during winter season in North Indian Plains and Solanaceous vegetables, Cucurbits and Legumes set seeds throughout the year under South Indian conditions [13].

### **3) Cheap labour availability**

Vegetable seed production particularly hybrid seed production demands much labour. Labour is needed for performing various cultural operations. Though mechanization reduces the human effort up to some extent, high cost fuel and energy limitations reduce full scale mechanization. Moreover, emasculation and pollination steps during hybrid seed production of vegetables solely depend on human labour [14]. Smaller flower structure of some vegetables need more devotion of time and reduces human efficiency. These operations require specially trained and skilled labour. India is ranked second in hand pollinated vegetable seed production in Asia next to China [13, 6]. Average number of man-days per acre required for hybrid seed production of various vegetables as follows: tomato-480; Chilli-1800; okra-180; brinjal-600; cucurbits-150 to 450 [4]. India is having huge human resources availing at reasonably cheaper rates [13]. This is attracting various corporate sectors of national and international origin to invest in seed business in India.

### **4) Vast Domestic and International market**

Due to high profits in vegetable cultivation area under vegetable cultivation is expanding enormously year by year. This creates huge demand for vegetable seed in the market. Requirement of vegetable seed is increasing annually. Requirement of the seed of open pollinated varieties is increased to 48000 t in 2005 from 30550 t in 2001-02 and the requirement of hybrid vegetable seed is increased from 346.2 t in 2001-02 to 994 t in 2005 [13,4].

This must have further increased due to increase in area to 8.49 mha in 2010-11. Now a day hybrids are replacing the open pollinated varieties (OPV) largely due to higher yield, uniformity and their improved quality for instance India is second largest user of hybrid tomato seed after USA [6]. Vegetable seed exports consist of 70% of total seed exports [6]. Vegetable seeds of either OPV or hybrids from India are having cosmic demand in foreign countries like Pakistan, Bangladesh and Saudi Arabia. The percentage share of various countries importing fruit and vegetable seeds from India is showed in Fig 1 [2]. The magnitude of fruit and vegetable seed exports has been increased from 12302 mt in 2001-02 to 17174 mt in 2012-13 (Fig 2) [2].

### **Influence of vegetable seed industry on economy**

#### **1) Income generation**

Seed production of vegetables is a highly remunerative business. Even from small land holdings very huge income can be generated. On an average the cost of seed production per acre of both OPV and hybrids ranges from 15000 to 30000 depending upon crop. In general 40-50 kg of OPV seed of tomato and brinjal can be produced from one acre land. Ten gram OPV seed of tomato and brinjal cost around 60-70 INR in the market. When compared to OPVs hybrids fetch more price as the cost of hybrid seed production is more due to the involvement of more labour in crucial emasculation and pollination and also due to their higher yield than OPVs. Hybrid seed production of sweet pepper is highly remunerative generating an income of 136000 INR per 0.75 acre followed by hot pepper generating an income of 41500 INR per 0.25 acre [13]. The hybrid seed production of tomato is having a benefit cost ratio of 2.77 whereas it is 2.02 for okra under Karnataka conditions (Table 3) [14]. It does mean that for every single INR invested in hybrid seed production of tomato will fetch 2.77 INR to the farmer.

#### **2) Employment generation**

As discussed earlier seed production is a labour intensive task. On an average one million people are employed in vegetable seed production activity [13]. Hybrid seed production of tropical vegetables is leading to an employment generation of 2.71 million man-days annually generating a net income of 373 million INR with the involvement of 10394 farm families [6]. Manual emasculation and crossing require skilled labour and it is very sensitive to perform. Hence, it is being performed mainly by women and young girls and they are being paid higher than other regular activities [14]. From an analysis based on Karnataka, it is apparent that emasculation and crossing have generated additional 313.6 and 276.89 working days (both male and female) in hybrid seed production of tomato and okra respectively (Table 4) [14]. Hybrid seed production of Solanaceous vegetables contribute 56.46% towards employment generation, followed by cucurbits 28.08% and okra 15.46% [4,6,13]. Since recent past contract seed production is largely being taken place where seed production by private firms is done in farmers' fields. Corporate bodies are providing inputs to the farmers and their technical staff periodically visits the seed production fields and provides necessary guidance to the farmers. Finally they purchase the produced seed back from the farmers. This reduces farmers risk and uncertainty in farming. So, huge number of farmers is showing interest in contract seed production. Approximately 0.17 million farmers are engaged in such contract seed production [4].

#### **3) Foreign Exchange Earning**

There is vast demand for vegetable seeds in the foreign countries. India is the ninth major exporter of fruit and vegetable seeds in the world there by earning good foreign exchange reserves. The major seed importing countries from India are Pakistan, Bangladesh, Saudi Arabia, Netherland and Korean Republic [3]. Fruit and vegetable seed exports consisted 3.37% of total horticultural exports from India in the year 2012-13 [2]. Trends in fruit and vegetable seed exports from India over the past few years are presented in Fig2. The foreign exchange generated through import of fruit and vegetable seeds have increased from 675 m INR in 2001-02 to 3477.2 m INR in 2012-13 [2].

**Table-1: Comparison of yields through own saved seeds and replaced quality seeds in various vegetable crops.**

Crop	SRR (%)	Yield (kg/ha)	
		Own saved seed	Replaced seed
Cabbage	100	--	370.26
Cauliflower	86.4	190.23	230.47
Chillies	83.7	68.21	85.73
Okra	92.4	140.55	230.87
Tomato	99.3	344.50	464.97

Source: [10]

**Table 2: India’s import of vegetable seeds in 2007-08**

Crop	Quantity (t)	Value (m INR)
Pea	105	5.2
Radish	252.63	47.4
Tomato	6.02	42.5
Cabbage	104.97	334.4
Cauliflower	37.62	226.5
Other vegetable seeds	1019.14	847.1
Total	1525.38	1503.1

Source: [15]

**Table 3: Cost and returns per hectare from hybrid seed production of tomato and okra under Karnataka conditions**

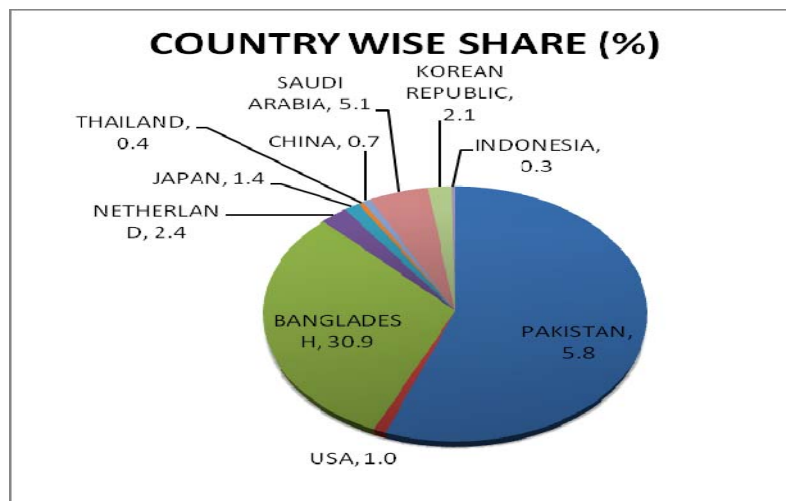
Particular	Tomato		Okra	
	Quantity	Value (INR)	Quantity	Value (INR)
Total cost		49775		38548
Yield	0.493 q	138118	5.66 q	77995
Benefit: Cost		2.77:1		2.02:1
Net income		88343		39447

Source: [11]

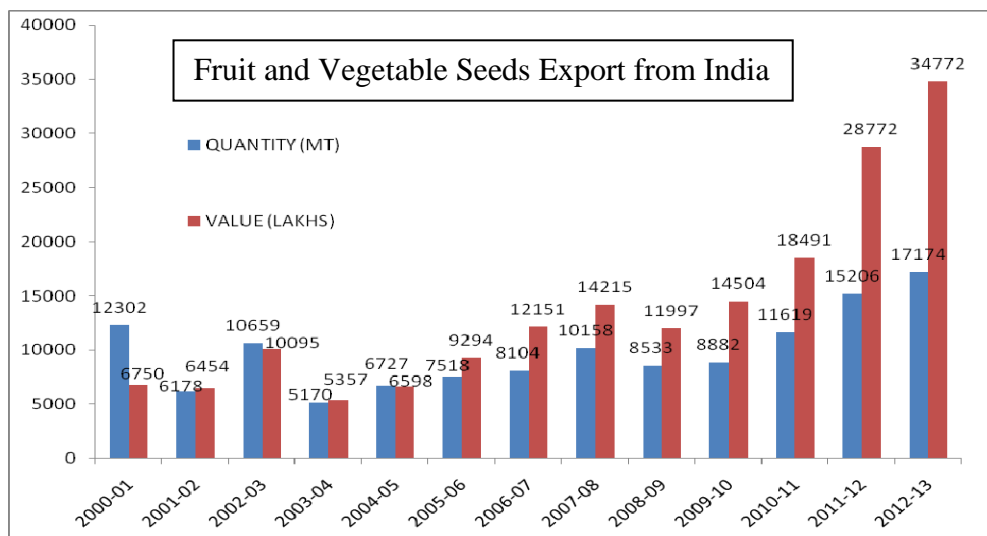
**Table 4: Employment generation through hybrid seed production in tomato and okra (M-Male, F-Female)**

Operation	Tomato					Okra				
	Own		Hired		Total	Own		Hired		Total
	M	F	M	F		M	F	M	F	
All Cultural	45.39	10.30	55.75	67.54	178.98	57.88	21.44	18.13	69.06	166.51
Emasculation and Crossing	5.48	21.30	11.34	275.5	313.6	6.67	11.56	1.44	257.22	276.89
Harvesting, Cleaning and Packing	3.56	5.78	37.12	73.90	120.36	7.61	10.84	2.39	85.94	106.78
Total	54.43	37.78	104.21	416.9	613.34	72.16	43.84	21.96	412.22	550.18

Source:[11]



**Fig 1: Country wise share of export of vegetable seeds from India**



**Fig 2: Fruit and Vegetable Seeds Export from India**

### Constraints in vegetable seed industry

#### 1) High Cost and Vague Market Demand

Vegetable seeds are highly expensive especially hybrid seeds due to involvement of more labour and other inputs [13,141]. Small and marginal farmers cannot afford the high cost of vegetable seeds. Moreover, farmers have to purchase the hybrid seeds ( $F_1$  generation) every time as the seeds harvested from the previous season ( $F_1$ ) get alter in their genetic constitution due to segregation and recombination in  $F_2$  generation. The demand for vegetable seeds in the market is vague. Unlike cereal seeds, excess cannot be used for human consumption. Hence, surplus production of vegetable seeds will leads to huge economic loss [13].

#### 2) Perishable Nature of Seed

Seed is a living entity and a biological product unlike fertilizers and chemicals manufactured in factories. So, it is subjected to death depending upon its genetic potentiality to remain viable and storage conditions [11,13]. Storage for longer period shows negative effect on given germination percentage and optimum crop stand and specified yield. Sometimes seeds may attain expiry time within storage or transport due to delay in marketing and performing long formalities to export. Unlike cereals, vegetable seeds are not the edible portions in majority of vegetables [13]. Even in cereals also seeds are not intended for consumption as they are treated with poison i.e. fungicide.

#### 3) Problems linked with contract farming

Seed production by multinational companies in developed countries is carried out in their own fields. But, in India seed production is being done in farmers' fields through contract farming. Besides giving credit benefit to the farmers, it adversely affects the quality of the seed [9]. Most of the Indian farmers are small and marginal and they may not be having scientific and technical knowledge on floral biology pollination mechanism, isolation distance, rouging etc. which plays a major role in quality seed production. Moreover, seed production is distributed over large areas. These not only result in the lack of uniformity in the seeds but also lead to contamination [9].

#### 4) Climate, Pest and Disease related problems

Seed production is a seasonal activity. Seed crops are grown in open conditions which are subjected to environmental extremes. High or low temperature and heavy or low rainfall leads to huge losses through crop failure. Moreover, flowering in most of the vegetables like tomato, okra, cucurbits and some temperate vegetables is temperature sensitive. Under climate change scenario flowering and pollination of these vegetables is going to be hampered [7]. Generally seed production is done over larger area with same variety to avoid contamination, but it is favourable for outbreak of pest and diseases epidemics. Insect borers like *Helicoverpa*, *Leucinodes* and *Earies* and diseases like purple blotch in onion, powdery mildew in cucurbits and bacterial and fungal wilts and rots can cause complete failure of the crop [5]. Management of these pest and diseases again increases the cost of production.

#### 5) Stringent seed policies and laws

Varietal notification and registration are compulsory and is time taking in bureaucratic system. Seed certification is another important time consuming task, though truthfully labeled seeds do not need of certification [13].

Private seed companies want to maintain secrecy about pedigree and sources in the development of variety, but varietal registration demands these details. Though PPV & FRA, 2001 protects the rights of these firms by preventing the reproduction of branded seed by farmers, it allows the researchers to conduct research except using these varieties as parents in hybridization programme without prior permission from originating plant breeder or institution. Export and Import regulations are inconsistent and politically motivated [16]. Pricing policy of vegetable seeds is ambiguous and does not provide the means to predict the market demand pricing in the ensuing season [13]. Arbitrary price controls based on political motivations lead to cost cutting even in critical processes which could affect seed quality adversely [16]. Moreover, there are no incentives from government to invest in R&D.

## CONCLUSION

It can be concluded that vegetable seed business will ever have huge scope to success and will play an important role in economy in countries like India where the occupation of majority of the people is agriculture. There is a greater need to make available quality seeds to the farmers in time and in sufficient quantity at reasonable prices. Seed laws are to be implemented strictly to ensure supply of quality seeds and to protect the farmers from spurious seeds. Government has to reduce precincts on import and export of quality seeds and planting materials. Policy making and implementations shall be free from political motivations. Strengthening of public sector in R&D is needed to compete with private seed companies so as to provide good quality seeds to the farmers at cheaper rates. The collaboration of both public and private sector may obviously help in quality vegetable seed production in India. There should be exchange of germplasm and other inputs between public and private sectors as per some pre made agreements. The mammoth seed companies may not be interested in such deals as these companies are having established R&D wings and their own technical staff. Nascent seed firms with moderate level of establishment and technical staff may find better option by such covenant.

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