

Vegetable Seed Industry and its Future Prospects

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India has a large vegetarian population which is dependent on variety of vegetables for their daily requirement of carbohydrates, proteins, fiber and nutrients. Though majority of population is consuming wheat and rice as their staple diet, it is always supplemented either by pulses or vegetables. In India, average household consumption of fruits and vegetables are estimated to be 152-170 gm/capita/day. Annual consumption (kg/person/annum) for vegetables is 75 kg for rural and 80 kg for urban population. The general recommendation for intake of fruits and vegetables is at least 400 gm per person per day as recommended by WHO (five servings of 80 gm each day) or about 146 kg/person/annum. For vegetables, the recommended intake requirement is at least 300 gm/day/person, which includes 50 gm of green leafy vegetables, 200 gm other vegetables and 50 gm roots and tubers. India grows more than 35 vegetable species depending on the regional recipes.

India is the second largest producer of fruits and vegetables in the world. About 10% of the fruits and 15% of the vegetables, out of total global production, are produced in India. Total cropped area of land under agriculture is 194 million hectares on which livelihood of 58% population is dependent today. Out of this about 8% area is under fruit and vegetables. Area under vegetables, including potato, sweet potato, tapioca, elephant foot yam and mushrooms is 9.47 million hectares.

Excluding these crops, cultivated vegetable area is more than 7.2 million hectares. Onion has the largest acreage which is around 1.18 mha. Hot peppers, both green and dry chilies, is grown

on an area of about 0.97 million ha. Other crops like tomato (0.80 mha), okra (0.5 mha.), eggplant (0.67 mha.), cauliflower (0.4 mha.), cabbage (0.38 mha.) and peas (0.48 mha.) are the major crops covering large area (Fig. 1).

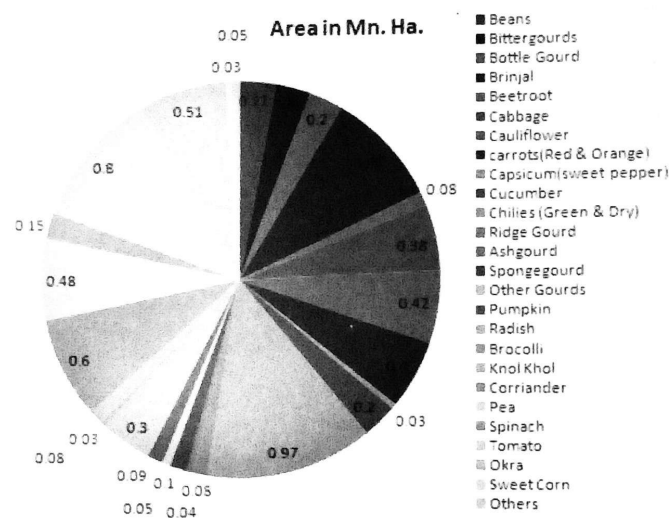


Fig. 1. Area under different vegetable crops in India

GLOBAL SEED INDUSTRY

Total Global Seed Market is estimated around \$50 Billion (Fig. 2) and is growing at the rate of 4-5%. The usage of New Breeding Technologies (NBT) like gene insertion, gene editing etc., also seed technologies like seed coating, pelleting, priming and enhancement of seed performance are fuelling the growth of agriculture sector and in turn driving the demand for performing seed.

The regional market share is changing rapidly because many farmers in developing countries are sowing high quality seed every year. Out of the total global seed market, vegetable seed market

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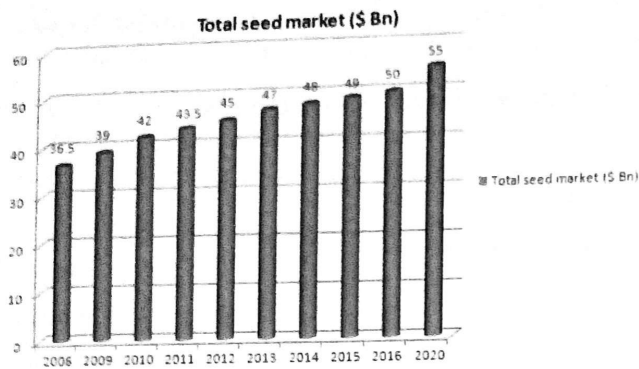


Fig. 2. Total seed Market (\$Bn.) as projected in 2016

is by value 14.5% while corn (34%), soybean (14%) and rice (11%) are other big crops that contribute significantly to the seed market (Fig. 3).

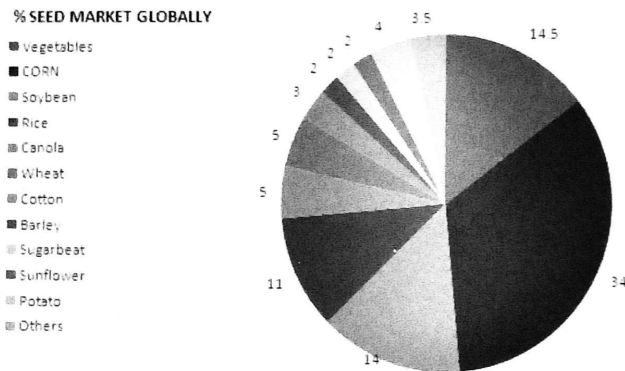


Fig. 3. Vegetable seed market in relation to other crop seed market globally

GLOBAL VEGETABLE SEED MARKET

Global vegetable seed market was around \$7.2Bn in 2016 which is 14.5% of the total seed market at present. Tomato seed occupies 15% of the total vegetable seed market while cabbage, sweet peppers, hot peppers and gourds have 7% each contribution to global vegetable seed industry. Other crops have 5-6% contribution. Based on the above information, fresh tomato production is highest in the world and is about 180 MT. Watermelons and onions are other crops which have more than 100 MT produced freshly each year. Globally, Seminis is the largest vegetable seed company followed by Limagrains, Syngenta and Bayer. Turnover of top 10 global companies of vegetable seeds covers 65% of the total vegetable seed market, globally. China has the fastest growing vegetable seed market followed by India and Africa

VEGETABLE SEED MARKET IN INDIA

In India, hybrid vegetable seed market is expanding. By volume, okra is the largest hybrid seed market followed by radish, onion and sweet corn. At present the total Indian traded seed market is Rs. 20,000 Cr (\$2.9 Bn.). Out of this, total vegetable seed market including Open Pollinated Varieties is Rs. 4000 Cr (\$580 million).

The largest vegetable growing area is in West Bengal followed by Uttar Pradesh, Bihar, Madhya Pradesh and Gujarat. Since all the states grow vegetables in different seasons, the area may vary due to various reasons including climatic conditions and price of the produce. The productivity of different vegetables vary between different states depending on the hybridization. Though West Bengal has the largest area under vegetables but productivity is lower than Uttar Pradesh. Productivity within crops also varies depending on sowing conditions and adaptation of hybrid seed in that crop in a particular state. The fresh vegetable production is highest in Uttar Pradesh & West Bengal followed by Bihar and Madhya Pradesh. Largest onion growing area is in Maharashtra and dry and green chilies in Andhra Pradesh. Okra is the largest crop in hybrid segment with the sale of more than 2000 MT whereas radish, onion and sweet corn are other big crops where hybrid seed sale is increasing

Both by volume and value, Okra crop is the largest in F1 seed markets. Out of the total value, okra has share of 13% while tomato and hot pepper have almost same volume; also value wise, they have share of 7.5%.

By value, Solanaceae crops (Mostly F1) have largest market share of 19%, Cucurbits have 17% and Malvaceae crops have 16% (where only one crop is there). Roots & Bulbs have share of 9% and Brassicas have market share of 8%; large seeded crops like Pea & Beans (Both OP's) and Sweet Corn (F1) hybrid have share of 24%; leafy vegetables has market share of 2% while all others have 5% market share.

Solanaceae crops

Solanaceae family is a large family including 102

Major vegetable seed crop groupings

Solanaceae	Tomato, sweet & hot pepper, eggplant
Cucurbits	Watermelon, melon, bittergourd, bottle gourd + all other gourds, pumpkin, cucumber
Malvaceae	Okra
Root & Bulb	Radish, onion, carrots, beet root
Brassica	Cabbage, cauliflower, broccoli, knol khol
Leafy	Spinach
Large seed vegetables	Beans, Peas, Sweet Corn,
Others	Coriander, all other minor crops

genera and 2500 species. Out of these, small number is of economically important genera for food and medicines. The genera of this family are spread throughout the world and widely distributed in tropical and temperate areas. Among the larger category, we have Potato (*Solanum tuberosum*), Tomato (*S. esculentum*), Eggplant (*S. melongena*), Peppers (*Capsicum annuum* and *C. frutescens*) and Tobacco (*Nicotiana tabacum*).

Tomato

Tomato crop is planted almost throughout the year in different parts of India. Tomato is grown in an area of seven lakh seventy thousand ha (0.80 mn. ha) which is almost 10% of the total area under vegetables. Out of the total area, 78% is planted with F1 seed (hybrids) while remaining 22% area is still grown with OP varieties. The average productivity is still very low which is about 26 MT/ha. With the introduction of high performing and disease resistant hybrids, the productivity and production is continuously improving.

Most of the hybrid tomato seed (95 MT) is sold by the private sector companies. There are more than 375 tomato hybrids in the commercial chain produced by different companies. Around 50 hybrids out of these have captured more than 80% of the total hybrid seed market for tomato. Leading companies in tomato hybrid seed segment are Bayer, Syngenta, Rasi Hyveg,

Seminis, Namdhari

Green & dry chilli

More than 65% of global green and dry chilies production in Asia, while Europe contributes 12% and Africa around 10%. China is the leading producer of green and dry chilies. Though the area under chilies in China is less than India but productivity is almost double than India.

In India, the area under green and dry chilies is 0.98 million ha. In India, major twelve types of chilly varieties are grown. These types are based on size, diameter, skin color, skin texture, skin thickness, upright or pendent, pungency, red dry colour value, dry fruit storability etc. Total F1 hybrid seed sale in India is around 100 MT. About 60% of the hybrid chilly seed is consumed in Andhra Pradesh and MP. Leading companies in Hot Chilli Pepper segment are Bayer, Bejo, Mahyco, Seminis, VNR, Syngenta, Rasi HyVeg and IAHS.

Sweet pepper

Sweet pepper is grown both in open field and under protected conditions under polyhouse. The exact acreage of polyhouse cultivation is not available but open field cultivation is happening in an area of 32000 ha.

Eggplant

The area under eggplant is on the decline and at

present is 0.68 million ha. The reason for decline is the confusion regarding Bt eggplant and also heavy use of pesticide on this crop. With this debate, consumer is not consuming much, particularly in urban areas. There are more than 10 types of eggplants in commercial cultivation and few companies breed all the available types. Leading players are Mahyco, UPL Advanta, VNR, Rasi HyVeg, Ankur etc.

Okra

Okra crop is grown in many countries and also consumed in many other countries where it is not grown. Though India is the largest producer of okra, Nigeria, Sudan, Iraq, Pakistan, Egypt, Ghana and Saudi Arabia are other countries where okra is grown and consumed. Okra is an important vegetable crop in India and grown throughout the country all year around. Area under okra is 0.52 mha

The productivity of okra is dependent on hybrid seed adoption in various states. The productivity varies from 4 ton/ha to 17 ton/ha with an average productivity of 12 ton/ha in the country. The major viral diseases in okra are Yellow Vein Mosaic Virus (YVMV) and Okra Enation Leaf Curl Virus (OELCV). Due to these diseases, which are prevalent throughout the country, many varieties and hybrids are going out of the commercial seed sale. The major companies whose hybrids are accepted by farmers are Bayer, UPL Advanta, Rasi, HyVeg Syngenta, JK, Mahyco, VNR etc.

Vegetable Brassicas

Vegetable Brassicas are important components of our food recipes and consumed by larger populations due to health benefits. Major categories of Brassicas cultivated in India are Cabbage, Cauliflower, Broccoli, and Khol Rabi (Knol Khol). The area under all these four crops is 0.90 mha. Cabbage (0.39 mha) and Cauliflower (0.41 mha) covers more than 89% of the total vegetable Brassica area.

Most of the seeds of Brassica hybrids are imported from Asia and Europe. Every year, more than 200 MT of Brassicas seed is imported in India. Very few companies are involved in breeding in these crops. Most of the companies

are breeding cauliflowers of different maturities in India while cabbage breeding is on small scale. Companies who are doing Cauliflower breeding in India are UPL Advanta, Rasi, HyVeg, Syngenta, Seminis, Namdhari, Mahyco etc.

Cucurbits

India grows large number of varieties of cucurbits. These include Bitter gourd, Bottle gourd, Ridge gourd, Sponge gourd, Round gourd, Ash gourd, Pointed gourd, Pumpkin, Watermelons, Melons, Cucumber (both slice & pickling types) etc. Total area under cucurbits is 1.25 mha. Major area is under Bitter gourd, Bottle Gourd, Cucumber and Watermelons. There are few companies who are doing breeding work in all the cucurbits crops. Leading companies are East West, Rasi, HyVeg, Mahyco, Syngenta, Seminis VNR, Namdhari, Chia Tai, UPL Advanta, Known you, Bejo etc.

Carrots

In India, three types of carrots are grown - the red imperator, French Nantes and Japanese Kuroda types. Tropical juicy red carrot is the most common and mostly open pollinated variety. Now companies are breeding hybrids in the red carrots. At present very small area is under red carrot hybrids. Most of the hybrid seeds of Nantes and Kuroda are imported in India. The total area under carrots is around 0.40 mha. Most of the OP red carrots seed is sold by the local companies. The major companies are Mahyco-Sungro, Rasi HyVeg, Durga seed, Pahuja seed, UPL Advanta etc. The major players in orange carrots are Clause, Bayer, Seminis, Syngenta, Tokita, Takii, Rasi HyVeg, Namdhari, Bejo etc. Rasi HyVeg is one of the few companies, who are breeding hybrid carrots in India.

Onion

Onion is a major vegetable grown in India. The total area under onion cultivation is 1.20 mha. This crop is not only used extensively within the country but is also the highest foreign exchange earner among horticultural crops. China is the largest producer of onion. Area of onion cultivation in China is less than India but productivity is 38% higher than India

Though the area under onion is more in China and India, but productivity in USA, Netherlands, Egypt, Iran, Turkey and Brazil is much higher. This productivity is due to better cultivation practices and high hybridization in onion

Presently onion seed market which is 90% OP is dominated by companies like Bejo, Panchganga, Mahyco, Jindal, Malav seed, East West, Rasi HyVeg, and many small players.

Many companies are working intensively for developing hybrids in onion. The major companies are Bejo, Bayer, East West, Rasi HyVeg, Namdhari etc.

Peas

Green peas seed market is one of the largest in large seeded vegetables. The area under green peas is around 0.48 mn.ha. Both public sector and private sector produce the seed of green peas. The old varieties like Arkel, Bonneville, Azad pea etc. are still produced by mainly public sector. There are new varieties which are introduced from outside and are being produced by private sector. Major companies selling seeds of Pea are UPL Advanta, Pahuja, Rasi HyVeg, Mahyco etc.

Radish

In India, mostly OP Radishes, are grown in both summer and winter conditions. The tropical radishes particularly Chetaki and summer long types are grown in summer and *Kharif* season while temperate types like Hill queen, Mino early and Japanese long are grown in *Rabi* season. The total area under OPs and Hybrids is 0.30 mha. Hybridization is increasing in radishes and many companies are using male sterile system to produce hybrids.

Hybrid radish seed of tropical and temperate type is becoming favorable for farmers. The major companies involved in Radish breeding are Syngenta, Seminis, Rasi HyVeg, Mahyco, Adventa etc.

Beet root

The area under beet root is around 75000 ha and

about 33% is under hybrids and remaining under old popular varieties like Ruby queen and DDR. The major companies dealing with hybrid beet root are Skata, UPL Advanta, Indo-American etc.

Beans

The area under beans is 0.22 mn. ha and mainly the seed of French beans are grown in India. The area under Yard Long Beans is also increasing. Beside that many other types of beans are also being grown by farmers.

Coriander

Coriander is planted both for fresh leaves and also for seed. The area under coriander is not stable and sowing area fluctuation is due to many reasons like price and availability of imported seeds of Coriander. The area during current year is 0.55 m ha.

Spinach

Indian spinach which is mainly Beta type is grown in an area of 0.15 mn.ha. Still very old varieties like All Green type are grown in almost all the states of India.

PRIVATE VEGETABLE SEED COMPANIES

There are around 300 private seed companies which are selling vegetable seeds. Based on the three activities of a seed company like R&D, production of proprietary seeds, and sale and marketing of seed in their own brand, 20% of the companies have all the three activities and intensively do research and produce proprietary seed. Around 60% of the companies are only producing and marketing the seeds. These companies either produce OPs of public or private-bred or licensing hybrids or do in-house production. Remaining 20% are either importing seeds from other companies or sourcing produced material from the market and packing and selling the seed. In vegetable seed sector, there are large seed companies with turnover of more than Rs 100 Cr, medium companies with turnover between Rs. 50 Cr to less than 100 Cr, small companies which are from Rs. 20 Cr to less than 50 Cr and the still smaller companies which are less than Rs. 20 Cr. (Fig. 4).

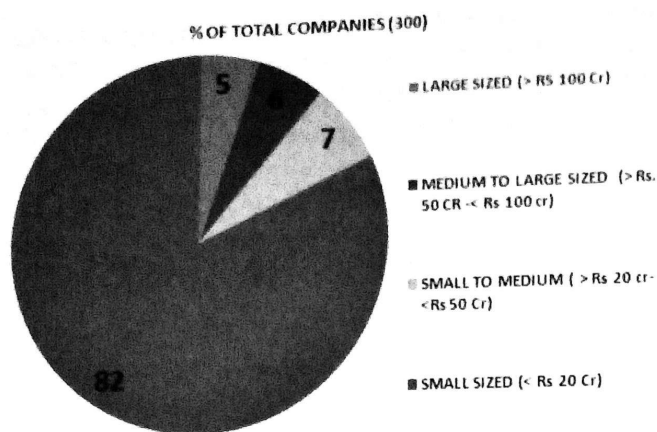


Fig. 4. Turn over based division of the companies

As depicted in Fig. 4, majority of the vegetable companies are small and mostly dealing regionally and selling mainly OPs. There are almost 15 multinational companies, operating in vegetable sector in India. Few companies are operating in only global vegetable crops while others are operating in both global and regional crops. The vegetable seed industry is presently growing at an average rate of 5%.

Future prospects of vegetable seed industry

All MNC's and top Indian vegetable seed companies are focusing on intensive breeding and use of advance biotechnologies to develop disease resistant and performing hybrids. The merger and acquisition will increase due to high cost of R&D and also protection of varieties. The smaller companies which are either producing and selling or only outsourcing the seeds will be under tremendous pressure due to inventories, legal obligations and protection of the varieties. Most of the multinational and Indian companies will produce seeds of key hybrids outside the country to avoid pilferage of their parental lines. Most of the vegetable growers are professional growers and always look for better and performing seeds. These farmers are not worried about the price of the seed or seedlings but they look for high performance, disease resistance and good quality. In future, farmers will accept new seed technologies like priming, pelleting and multi coated seeds. New high tech nursery units will be established for seedlings and most of the

farmers will buy seedlings rather than the seeds. The grafted seedlings on better root stocks will also become popular particularly in tomato, melons, eggplant etc. Due to seasonal fluctuations and high disease pressure, most of the big and professional growers will opt for protected cultivation. Lots of poly-houses are under construction due to subsidies and farmers are getting training for protected cultivation. Crops like Cucumber, Sweet peppers and Lettuce are presently preferred for cultivation under protected conditions.

CONCLUSION

Vegetable seed industry is a very dynamic industry globally and is impacted by many factors. Due to varied crop maturities and growing cycles, these are influenced by climate fluctuations, diseases etc. Since these crops can be grown both under open field conditions and controlled and protected conditions, there is ample opportunities to exploit the genetic variabilities of different crops. In India, since mostly crops are grown under open field conditions and also year around, the impact of biotic and abiotic factors are significant. The life of a hybrid or a variety is reducing and there is a challenge for the vegetable breeders to develop new varieties/hybrids in short time. The private vegetable seed industry which occupies almost 90% of the seed market of vegetables is reducing the turnaround time for developing performing genotypes. The advanced technologies will play an important role in resistance traits introgression.

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