



Research and development issues prioritization for vegetable seeds in India: A perception study

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ABSTRACT

Seed is recognized to be the cheapest source, yet most critical single input for enhancing vegetable productivity. Use of good quality seeds can result in 15–20% yield increase. The Indian vegetable seed sector is established with tremendous potential to grow beyond boundaries of domestic market. Being high value per unit weight, vegetable seed segment has a significant share in the overall seed market in monetary terms. Although the price of vegetable seeds in market is very high, farmers are facing problem of spurious seed, low germination percentage and unavailability of quality seeds on time. Research and development interventions are required to overcome these problems and an effort has been made to identify the priority areas where interventions are required in vegetable seed sector. This study was undertaken during 2014-16 by conducting a survey of vegetable and seed experts in which major constraints in vegetable seed sector were identified. The constraints are rank ordered as perceived by the respondents like exorbitantly high price of private sector hybrids (Score-680, Rank-1), unavailability of quality seeds of recommended/released hybrids and OP varieties of vegetables (Score-658, Rank-2) and many more which have been discussed and will draw attention on the issues related to the vegetable seed sector which needs priority in further research.

Key words: Problems and prioritized research areas, Quality seed, Vegetable seed sector

Seeds are the primary basis for human sustenance as they are the repository of the genetic potential of crop species which is used in crop improvement (FAO 2017). With increasing living status and consciousness of the masses towards the health and nutritional security, the consumption of vegetables has increased over the years. Although vegetable production in India has increased (187.47 mt) with time but shrinking land resources (10.43 mha) and increasing environmental challenges have made the development and use of quality seeds more important to meet the increasing demand of vegetables by Indian populace (NHB 2018-19, 1st advance estimate). Food, nutritional and socio-economic security of country is therefore dependent on the seed security of farming community (FAO 2016). Production of quality seed and timely availability of the quality seed to farmers is a major area which has to be taken into consideration. Quality seed alone can enhance the total production about 15–20% and it can be raised up to 45% with effective management of other inputs (seednet.gov.in and Ali 2016). But the irony is that the vegetable growers of India do not get quality vegetable seeds at proper time in

spite of readiness to spend considerable money. They do not have knowledge to judge the quality of the seed. Improper germination of the vegetable seeds and problem of mixture of different variety has also been reported. Another major problem is very weak and unorganised seed production system in India. Unavailability of skilled labour for hybrid vegetable seed production and development of proper seed storage structure also needs attention (Ali 2016). On this background, this study was planned to identify the priority areas in vegetable seed sector where future research and development efforts should be channelized for strengthening vegetable seed sector in the country.

MATERIALS AND METHODS

Present study was carried out through e-survey in the year 2014-16. A structured questionnaire was prepared by collecting items or statements of problems, related to the vegetable seed sector which needs attention for future research and development. Initially 33 number of items were collected and sent to 10 subject experts to check the relevance and consistency of the items to the subject of investigation. A mini Delphi technique (Dalkey and Helmer 1963) was followed in this process and 11 items or statement of problems were finalised for data collection. The survey questionnaire was sent purposively to 50 scientists of ICAR institutes, 50 teachers of SAUs and 50 subject matter

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specialists of KVKs who deal with vegetable crops and seed sector, for their response. The questionnaire contained multiple choice type questions and the respondents were asked to score each problem in a five-point continuum ranging most important (5), important (4), undecided (3), less important (2) and not so important (1), as they perceived, to calculate rank wise priority of the problem statements. The total score for each problem was obtained by summing the scores given by 150 respondents and accordingly the rank of the problems was assigned. Seed quality parameters like seed germination and seedling length were measured following ISTA Rules (Anon 2015), whereas seed vigour indices following Abdul-baki and Anderson (1973).

RESULTS AND DISCUSSION

Indian seed sector comprises of formal and informal system where formal system supplies only 30% of seeds while informal system fulfils 70% of seed demand (Agarwal 2012). Formal system includes public sector agencies such as ICAR, SAUs, NSC, SSCs and private seed companies. Public sector is mainly dealing with seed production of low value and high-volume crops (cereals and pulses) to meet the food security of the country while private companies are focused on high value and low volume crops like vegetables, hybrids and bt-cotton etc. There are more than 500 private seed companies in India. Among them only 70 have their own Research and Development system and 24 companies linked with multinational companies.

These 24 companies are fulfilling 50% of commercial seed requirement of high value crops in India (Agritex 2016). These companies produce their own seeds by using custom seed production approach as well as they import seed from foreign collaborators and market them in India. Net worth of vegetable seeds alone is ₹ 20 billion (Agarwal 2012). But the price of private sector seed is exorbitantly high in comparison with public sector (cumulative score 680, Rank-1) (Table 1). For example the rate of hybrid seeds of tomato, brinjal and chilli from ICAR-IIVR are ₹ 20000.00, ₹ 10000 and ₹ 15000 respectively (www.iivr.org.in), whereas the rates of the same from private sector are ₹ 30000-45000 for tomato hybrid, ₹ 15000-20000 for brinjal hybrid and ₹ 18000-25000 for chilli hybrids. This is one of the reason for increased problem of spurious seed, i.e. selling open pollinated or F2 seeds in the name of hybrids by the informal seed sector. This problem got an average rank of 8th (cumulative score 582) (Table 1) in priority study. These malpractices should be controlled through incorporation of molecular and biotechnological techniques such as DNA fingerprinting, protein based methods and antigen antibody based methods in Indian seed certification system.

Informal system like farm saved seed, exchange of seeds among growers through local trading and co-operative societies, selling grains as seeds and selling without label etc. comprises 70% of supplied seeds which is very cheap and easily available but there is no quality assurance especially genetic purity and germination (Rank 4th, cumulative

Table 1 Distribution of the respondents categorized priority parameters from most important (5) to not so important (1)

Problems in vegetable seed sector	5	4	3	2	1	Score	Rank
The cost of cultivation goes high as the prices of private sector hybrids are exorbitant.	100	34	12	4	0	680	1
Timely availability of recommended or released open pollinated varieties or hybrids of vegetables not ensured.	76	60	10	4	0	658	2
Specific package of practices for producing seeds of recommended or released hybrid varieties of vegetables not available.	80	52	14	2	2	656	3
Quality assurance of informal sector supplied seeds of vegetables is not available.	80	46	18	0	6	644	4
Actual requirement of vegetable seeds in all over country not known (all are estimates) because actual area under vegetables cultivation is not available.	62	60	20	4	4	622	5
Vegetable growers are not being capacitated to judge the quality of their own as well as procured seeds and not expertised to produce and maintain planting materials of asexually propagated vegetable crops.	46	74	26	2	2	610	6
Unavailability of skilled labour for vegetable seed production (hybrid seed production)	54	54	30	6	6	594	7
Spurious seed problem in seed supplied through unorganised sector	46	54	38	10	2	582	8
Data on conversion of breeder seed to foundation and certified level not available.	34	78	22	10	6	574	9
Vegetable seeds retained at farmers' house generally do not perform well due to faulty storage procedure.	34	70	32	10	4	570	10
Due to lack of awareness vegetable growers save the seed of hybrid varieties and it segregates when they sow it next time.	46	48	28	18	10	552	11

score 644) (Table 1). The Indian seed sector is highly vibrant and energetic because of its diverse agro-climatic condition which is advantageous for producing quality seed of tropical, temperate and sub-tropical crop varieties (Ali 2016). However, vegetable seed production is region and time specific in nature and sporadic distribution of vegetable seeds could not meet the demand of entire country. Adding to that, irregular power supply, improper transport and scanty connectivity in villages lead to reduced production and utilization of quality seeds (Raju and Reddy 2015). Therefore, timely availability of quality vegetable seeds is another major problem for Indian vegetable growers (Rank 2nd, cumulative score 658) (Table 1). To manage the timely seed availability, prior planning is required. Unavailability of quality seed at proper time and reasonable price along with many other factors are mainly responsible for low seed replacement rate. Another problem is that actual requirement of vegetable seeds in the country is not known. So, it is very difficult to predict the demand of vegetable seeds. This problem got an average rank 5th (cumulative score 622) (Table 1) in priority table.

In India, seed is produced through generation system of seed multiplication. Three long years are required for certified seed production from breeder seed. Hence, at least three years before, the demand of certified seed should be estimated so that required quantity of breeder seed could be produced in advance. In last two decades, the ICAR institutes and SAUs have made significant contribution to fulfil the breeder seed (BS) requirement (Paroda 2013). In the year 2018-19, Breeder seed production of different vegetables was 15949.81 kg against the 14260.66 kg indent, hence 1689.15 kg breeder seed was surplus in vegetable seed sector (dacnet.nic.in), but still it is not converting into foundation and certified seed as per desired ratio. Data on conversion of breeder to certified seed is not clearly available. This problem got an average rank of 9th (cumulative score 574) (Table 1) in priority table. Probably this may be due to improper coordination between various seed producing associations and lack of an industry watchdog for remedy of problems (Poonia 2013). In this context, an effective partnership between public and private seed organizations and emerging concept of contract farming is highly anticipated (Paroda 2013).

Normally, package of practices for vegetable production are available but the special package of practices for quality seed production is not adequately available for most of the vegetables. Since vegetable seed production differs from normal vegetable production in many aspects such as isolation distance, rouging, harvesting stage, seed extraction procedure, post-harvest management etc, this problem of unavailability of specific package of practices for producing seeds of recommended or released varieties and hybrids of vegetables got an average 3rd rank (cumulative score 656) (Table 1) in priority table. Vegetable seed production is labour intensive and requires involvement of skilled labours especially for hybrid seed production. But rapid urbanization and industrialization is posing a threat to availability of

skilled labour (Poonia 2013). Although mechanization may solve the problem of shortage of workers at the time of field preparation, intercultural operations and harvesting, but hand emasculation and pollination for hybrid seed production require skilled labour. Labour problem got an average rank of 7th in priority table (cumulative score of 594) (Table 1). According to a report on agricultural wages, payment of minimum wages is a major issue in the agriculture sector especially in seed production in India and this may be the reason for labour scarcity (Venketeswarlu and Kalle 2012).

Most of the farmers, especially the poor and marginal ones, have lack of awareness regarding the seed quality of vegetables and unknowingly use farm saved seed of varieties or even hybrids or seeds from informal sector which segregates in future generation and ultimately lowers the vegetable yield and quality (Bala 2005). Even when farmers sow hybrids, they use their own farm saved seed which reduces the yield and quality due to loss in hybrid vigour (Morris *et al.* 1999). This problem got an average rank of 11th (cumulative score 552) (Table 1) in priority study. The problem of use of informal sector supplied seed also raises the issue of lower seed replacement rate. Seed production through participatory approach and implementation of Seed Innovation System in India (SISI) approach will be key tool for increasing flow of technological knowledge among farmers (Lal 2008). Along with that, farmers are also unaware about the storage of farm saved seed therefore; vegetable seeds retained at farmers' house generally do not perform well due to faulty storage procedure. Raju and Reddy (2015) revealed that poor storage of seed led to more pest damage in rice seed in Andhra Pradesh. This problem got an average rank of 10th (cumulative score 570) (Table 1) in priority study and lack of expertise to judge the seed quality and maintain planting materials of asexually propagated vegetables crops got an average rank of 6th in priority table. Results of seed storage study at ICAR-IIVR, Varanasi revealed that quality of seed stored with zeolite beads was at par to initial quality (before storage), while it drastically reduced when the seeds were stored in simple cloth bags for 18 months (Table 2). Therefore, seed storage with zeolite beads may be the good practice of seed storage at farmer's level to maintain the seed quality for next growing season. However, the adequate availability of zeolite beads is still a problem and steps for its easy availability will have to be taken up for its adoption at the grower's level.

Standardization of appropriate invigoration protocols as well as seed coating and pelleting technologies, for enhancing planting value and storability of high value and poor storer seeds (Copeland and McDonald 2001) are also required. Researchers should focus on development of biotic and abiotic stress resistance in seed to cope up the changing climate problem.

Quality seed in India is supplied through a huge public as well as private seed sector which should be restructured through proper execution of policies. Generation system of seed multiplication should be strengthened. Analysed data shows that the production of breeder seed in different

Table 2 Effects of different storage methods (zeolite beads and cloth bags) at ambient temperature on seed storability

		Okra (K. Pragati)	Cowpea (K. Kanchan)	Pea (K. Nandani)	Bottle gourd (K. Ganga)
Germination (%)	Before storage (initial)	72.5 ^a	91.25 ^a	95.5 ^a	92.75 ^a
	Storage in zeolite beads	67.5 ^a	88.75 ^a	93.5 ^a	89.5 ^a
	Storage in Cloth bag	56 ^b	65.5 ^b	67 ^b	72 ^b
	CD @ 0.05	7.55	3.147	4.861	3.98
	CV	5.076	1.17	1.790	1.10
Seedling length (cm)	Before storage (initial)	19.26 ^a	21.94 ^a	19.06 ^a	29.10 ^a
	Storage in zeolite beads	17.77 ^a	20.34 ^a	14.76 ^b	24.61 ^b
	Storage in Cloth bag	11.82 ^b	13.38 ^b	10.93 ^c	14.14 ^c
	CD @ 0.05	3.12	2.153	2.550	1.384
	CV	6.03	3.65	5.37	1.923
Vigour index-I	Before storage (initial)	1423.84 ^a	2065.57 ^a	1933.56 ^a	2698 ^a
	Storage in zeolite beads	1202.83 ^a	1872.40 ^b	1624.86 ^{ab}	2196 ^b
	Storage in Cloth bag	706.56 ^b	857.67 ^c	764 ^b	1084 ^c
	CD @ 0.05	242.73	154.68	867.92	121.0
	CV	6.87	3.031	18.93	1.91

Values in the table are mean of three replicates. Where, Seed vigour index-I = Germination % × Seedling length (Root + Shoot)

crops is sufficient to meet a desired seed replacement rate (i.e. around 30% in self-pollinated species, 50% in cross pollinated species and 100% in hybrids). Hence, even if the SRR is increased to 50%, the domestic seed market will dramatically increase thus bringing India's seed sector on 3rd position in economic terms (Paroda 2013). This will ensure timely availability of quality seed with reasonable price at right place. Farmers' awareness in seed multiplication and quality assurance in order to improve quality of seed produced in the informal sector through proper capacity-building activities and appropriate credit schemes should also be strengthened. Private-public partnership should be encouraged for production and supply of quality seeds along with guiding small and marginal farmers to convert farmers field into an economically viable farm enterprise. Production of foundation and certified seeds by the farmers themselves may be one of the viable options for doubling farmer's income by 2022 in India. Generally, farmers are not aware about the certified seed production procedure. Hence, they require adequate training regarding the registration for seed production, seed certification, field inspection, labelling and tagging of seeds. Finally, the research priorities in vegetable seed sector which have been identified in this paper may be considered for research coordination and inform research managers for policymaking in a sustainable manner. Research, education and extension organizations in the country may evaluate their present line of work and may allocate resources according to the identified priorities in vegetable seed sector.

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