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Perception of constraints in chickpea production in India

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India is the largest producer of chickpea (*Cicer arietinum* L.), accounting for about 67% of global production (GOI 2011). Out of 10.94 mt chickpea produced world over from 11.99 m ha, India produces 7.48 mt from 8.21 m ha (FAO 2012). Chickpea, which forms an important source of nutrition for the vegetarian Indian populace, is cultivated under diverse agro-ecological niches both in rainfed and irrigated systems, as mixed and mono-crop, under low and high input conditions. Uncertain and erratic rainfall creates formidable barrier for timely planting and proper growth (IIPR 1999). Non-availability of high-yielding varieties resistant to insect pests and diseases is the major bottleneck in realizing its potential yield (Ali and Kumar 2003). However, yield growth rates of chickpea in India are almost stagnant, hovering around 8.5-8.9 q/ha for the last one decade or more (GOI 2011). Overall average yield losses due to the major production constraints were about 56% or 0.62 tonne/ha (Waddington *et al.* 2010) or 1.1 tonne/ha (Li *et al.* 2011) in south Asia. Constraints in chickpea have been listed by different researchers (Johansen *et al.* 2000, Ali and Kumar 2003, Waddington *et al.* 2010) while analysing reasons behind its stagnant yield. Abiotic and biotic stresses were the dominant chickpea constraints throughout the Indian farming systems (Waddington *et al.* 2009). In this context, the present study was undertaken to identify the major constraints in chickpea production in India as perceived by personnel of KVKs. Chickpea suffers from various ravages of insect pests and diseases in India. These pests are either of wide distribution or of regional importance, which inflict heavy loss to the crop.

In India, annually the losses due to insect pests are estimated around 7-15% with monetary loss of 10 950 m Indian rupees in chickpea (Saxena *et al.* 2010), whereas diseases like *Fusarium* wilt are most serious constraints to chickpea productivity causing up to 100% losses (Gurha *et al.* 2003). However, in order to prioritise research at the national level, there is need to rank different constraints logically to assess their relative importance, which could not be noted in available literature. In this context, the present study was undertaken to identify the major constraints faced by the chickpea growers in India as perceived by KVK personnel.

The study was conducted in 11 states covering four pulse growing zones of India, viz. North Western Plain Zone (NWPZ), North Eastern Plain Zone (NEPZ), Central Zone (CZ) and South Zone (SZ) involving 80 Krishi Vigyan Kendras (KVKs). The method used was written questionnaire developed with 21 common problems faced by chickpea growers, which were sent to the KVK personnel for their response. The respondents were asked to rank constraints in order of importance. The first rank was assigned the score 21 while the twenty-first ranked constraint was allotted a score of 1. Total score of each constraint for all the 80 districts were summed and ranks worked out for each problem in different chickpea growing zones as well as at the national level. Thus, statistical analysis has been done using scoring method with commensurate weightage to various constraints, which is defined as a linear combination of these individual counts against the constraints (Ramasubramanian *et al*. 2014). The respondents were also asked to report the extent of damage or yield loss (%) due to various biotic constraints in chickpea production according to their perception. After that, the biotic constraints were quantified on the basis of Rank Based Quotient (RBQ) and Value Based Index (VBI) by the formula (Ray 1996): $RBQ = S[\{F_i(n + 1 - I)\}/N \times n] \times 100$ where, F_i = Frequency of respondents for i^{th} rank, N = number of respondent, n = number of rank, I = rank order. Then, the VBI was calculated for each biotic constraint by multiplying RBQ and per cent losses due to various biotic constraints reported by the respondents. The biotic constraint having highest VBI was given the first rank.

The extension scientists of 80 KVKs responded and ranked the constraints differently as per their respective districts and chickpea cropping situation therein. *Helicoverpa armigera* was the dominant chickpea constraint which ranked first followed by lack of knowledge about IPM (overall rank 2) and non-availability of good quality seed (overall rank 3) (Table 1). Fusarium wilt (*Fusarium oxysporum* f sp *ciceri*) occupied the fourth rank. The extent of yield losses in chickpea due to biotic stresses, viz.

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Table 1 Constraints in chickpea production as perceived by personnel of KVKs

Constraints	Zone-wise rank position				Overall rank
	NWPZ	NEPZ	CZ	SZ	
Helicoverpa armigera	1	2	3	3	1
Lack of knowledge about IPM	3	4	1	4	2
Non-availability of good quality seed	5	1	4	2	3
Fusarium wilt	2	3	2	5	4
Non-availability of reliable biocontrol agent	7	3	5	6	5
Lack of knowledge about crop production	9	6	5	7	6
Drought	8	10	9	5	7
Other fungal diseases	14	5	12	1	8
Lack of knowledge about inputs	6	7	6	12	9
Stored grain insect pests	11	8	8	9	10
Non-availability of reliable insecticide	15	8	7	8	11
Non-availability of reliable fungicide	17	12	10	10	12
Termite	4	11	11	14	12
Other insect pests	19	8	13	8	13
Non-availability of fertilizer	14	13	9	15	14
High temperature at seedling stage	12	15	14	10	15
High temperature at maturity stage	10	9	16	13	15
Frost	16	6	18	14	16
Viral diseases	18	17	16	8	17
High temperature at flowering stage	21	14	15	11	18
Nematode	20	16	17	16	19

Helicoverpa armigera, Fusarium wilt, other insect pests and fungal diseases were reported by the respondents. On the basis of RBQ and VBI, it was found that *H. armigera* (VBI = 2303) is the major threat to chickpea causing highest damage to the crop. Fusarium wilt (VBI = 2136) was reported to be the second most important biotic constraint followed by other insect pests (VBI = 466) and fungal diseases (VBI = 428) in the order of damage level reported in chickpea (Table 2). The extent of yield losses (%) that occur in chickpea due to various biotic stresses as reported by extension scientists were highest in *H. armigera* (25%), while losses due to *Fusarium* wilt, other insect pests and fungal diseases were perceived to cause 24, 12 and 10%, respectively. This finding agrees with an earlier observation (Waddington *et al.* 2010), which indicates that biotic constraints happen to be the most important issue in chickpea crop culture. He also noted that yield losses due to *Helicoverpa* pod borer was 12%. Ali and Kumar (2003) indicated large area under rainfed cultivation, low risk-bearing capacity, resource-poor marginal farmers, unavailability of seed of improved varieties adapted to

Table 2 Prioritization of biotic stresses based on Value Based Index (VBI)

Biotic constraints	RBQ*	Av. yield loss (%)	VBI	Rank
Helicoverpa armigera	92.1	25	2303	I
Wilt	89.0	24	2136	II
Other insect pests	38.8	12	466	III
Other fungal diseases	42.8	10	428	IV

*Rank-based quotient

diverse growing condition in adequate quantity with poor seed replacement rate, poor plant stand and crop management, poor response to high input conditions and better management, biotic (*Fusarium* wilt, *Helicoverpa* pod borer, etc.) and abiotic (uncertain and erratic weather conditions, cold sensitivity during vegetative and flowering stages, high temperature during reproductive stage, terminal drought, salinity/alkalinity, deficiencies of secondary and micro-nutrients) stress, socio-economic factors as important constraints in chickpea crop culture. Waddington *et al.* (2010) found that yield losses due to management related aspects, biotic, abiotic stresses and socio-economic issues were 23%, 32.4%, 25.4% and 18.6%, respectively and indicated that the yield loss due to constraints in chickpea production in south Asia totalled 580.5 kg/ha with a yield gap of 50%. Berger (2007) considered terminal drought the most important and widespread abiotic stress of dryland chickpea in South Asia. Li *et al.* (2011) found worsening drought (water deficit) or soil surface drying during crop establishment and progressive drought with developing crop and poor grain filling or excessive soil moisture at any stage of crop growth observed at times to be important constraints in chickpea production in south Asia that contribute to 9.5% (range: 6.9-15.6%) yield gap in the crop. Thus, these earlier findings matched with ours. We could not provide detailed status of viral diseases, termite, nematode and stored grain pests as relevant to chickpea crop due to insufficient response on these aspects.

At the national level, annual loss in chickpea production due to *Helicoverpa* pod borer was estimated to be 0.4 mt or 14.6% (range: 3.1-32.9%), which was 15% or 300 kg/ha in the state of Uttar Pradesh alone (IIPR 1999). Saxena *et al.* (2010) indicated 7-15% crop loss in chickpea due to insect-pests, which could be 0.73 mt/annum in India, valued at 10,950 m Indian Rupees, while Waddington *et al.* (2010) found *Helicoverpa* pod borer responsible for 12% yield loss. These did not match accurately with our finding. Surprisingly wilt did not figure among the constraints indicated by Waddington *et al.* (2010). Thus, findings in this study at national level agreed with some previous findings of studies conducted in limited scales while they disagreed in some cases.

SUMMARY

This could be the first study in chickpea of its kind to consider several common problems and investigate at

national level to rank them scientifically in quantitative terms as per their relative importance. In order to decide research priorities for chickpea, break yield barriers of the crop, and design innovative policies on improved resource management in participatory experimental agricultural technology development linked to the farmers' needs, these findings could be put to use. Further, such studies could be conducted using other methods to validate findings in this study apart from pinpointing yield losses due to Botrytis gray mould and root rot complex, which were specifically not touched in this investigation.

REFERENCES

Ali M and Kumar S. 2003. Chickpea research in India: an overview. (*In*) *Chickpea Research in India,* pp 1–13. Ali M, Kumar S and Singh N B (Eds). Indian Institute of Pulses Research, Kanpur.

Berger J D. 2007. Eco-geographic and evolutionary approaches to improving adaptation of autumn-sown chickpea (*Cicer arietinum* L.) to terminal drought: the search for reproductive chilling tolerance. *Field Crops Research* **104**: 112–22.

FAO. 2012. Food and Agricultural Commodities Production (Food and Agriculture Organization). (*In*) http://faostat.fao.org/site/567/DesktopDefault.aspx, retrieved 20 Jan 2012, 2114 hrs IST.

GOI. 2011. Agricultural Statistics at a Glance. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. IN: http://eands.dacnet.nic.in/ latest_2006.htm, retrieved on 10 Dec 2011 at 1243 hr IST.

Gurha S N, Singh G and Sharma Y R. 2003. Diseases of chickpea and their management. (*In*) *Chickpea Research in India*, pp 195–228. M Ali, S Kumar and NB Singh (Eds), Indian Institute of Pulses Research, Kanpur.

IIPR. 1999. *Technology for Increasing Pulses Production in India.* Indian Institute of Pulses Research, Kanpur, 108 p.

Johansen C, Duxburv J M, Virmani S M, Gowda C L L, Pande S and Joshi P K. 2000. *Legumes in Rice and Wheat Cropping Systems of the Indo-Gangetic Plain - Constraints and Opportunities.* International Crops Research institute for Semi-Arid Tropics, Patancheru, India and Cornell University, Ithaca, New York, USA, 230 p.

Li X, Waddington S R, Dixon J, Joshi A K and Carmen de Vicente M. 2011. The relative importance of drought and other water-related constraints for major food crops in South Asian farming systems. *Food Security* **3**: 19–33.

Ray G L. 1996. *Extension Communication and Management*. Naya Prakash Publisher, Kolkata, 353 p.

Ramasubramanian V, Kumar A, Prabhu K V, Bhatia V K, Ramasundaram P. 2014. Forecasting technological needs and prioritizing factors in agriculture from a plant breeding and genetics domain perspective: A review. *The Indian Journal of Agricultural Sciences* **84**: 311–6.

Saxena H, Singh S K, Duraimurugan P, Mohapatra S D and Soujanya P L. 2010. *Pulse Entomology in India: Retrospectives and Perspective.* Indian Institute of Pulses Research, Kanpur. 77 p.

Waddington S R, Li X, Dixon J and Hyman G. 2009. Production constraints and opportunities for six priority GCP food crops in farming systems with high poverty. (*in*) *A report for the Generation Challenge Program (GCP) of the CGIAR covering GCP SP5 project G4008.36: Getting the focus right: food crops and smallholder constraints*, CIMMYT Impacts Targeting and Assessment Unit, México. 216 p.

Waddington S R, Li X, Dixon J, Hyman G and Carmen de Vicente M. 2010. Getting the focus right: production constraints for six major food crops in Asian and African farming systems. *Food Security* **2:** 27–48.