

## Trends of seed production, varietal scenario and future prospects in barley

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Agriculture is one of the prime sectors in Indian economy and more than 58 per cent of the Indian population depends upon agriculture for their livelihood. However, with this quantum of population dependency, agriculture contributions were 13.9% during 2013-14, while compared with industry (26.1%) and service (59.9%) sectors, respectively (Chauhan *et al.*, 2016). Seed is the most crucial input in agriculture to deliver technological interventions for enhancing crop production and ensuring livelihood security. The success of other factors is greatly dependent upon quality seed for a good harvest. Seed being a key factor for higher productivity, its production, supply and quality aspects are always prime concern for sustainable growth and achieving food security (Manjunatha *et al.*, 2013). For yield maximization and enhancing net profit in barley like other cereals, quality seed production and availability is the first and utmost requirement for long term gain realization. The seed indents and supply are integral parts for the higher productivity for any crop, therefore the presented study was undertaken to analyse the recent barley breeder seed production trends of indented varieties for future prospects.

Barley is a primitive, sacred and one of the first domesticated cereals, which is also known as crop of resource poor small and marginal farmers (Kumar *et al.*, 2013; Pasam *et al.*, 2012). Barley is a model crop, which is adapted for harsh climates especially drought, salinity and other abiotic stresses (Baik and Ullrich, 2008; Nevo and Chen, 2010). Barley is one of the staple food resources altogether with other cereals *i.e.* rice, wheat and maize and

contribute towards world wide energy intake in human diet (Brog *et al.*, 2009). It ranked fourth after maize, rice and wheat with 144.33 mt production, during 2014 globally (FAOSTAT, 2016; Kumar *et al.*, 2015). Barley is a key crop among dry land cereals and grown over 100 countries mainly with dry agro-ecological conditions for food and feed purposes. Apart from food and feed, barley is also an industrial crop for brewing and malting due to its husk, enzymatic activities and beta-glucan. Due to low water and nutrient requirement, early maturity and malt based industries, barley is also preferred *Rabi*, crop in areas with scanty rainfall and as well as high input regions of India *i.e.* Rajasthan, Uttarakhand, Himachal Pradesh and Haryana, Punjab, Uttar Pradesh, Madhya Pradesh etc.). Barley also serves as good dual purposes cereal for green fodder followed by good grain harvest due to its early vigour, foliage growth, regeneration capacity and nutritive values (Verma *et al.*, 2016).

The last 10 years (2005-06 to 2014-15) breeder seed allocation and production data are presented in table 1 and Fig. 1. The perusal of data indicated that from 2005-06 to 2009-10 the indents were increased from 360.55 q to 2464.50 q, respectively (Table 1).

Similarly, the production of indented varieties also exhibited an increase from 851.61 q to 3077.79 q from 2005-06 to 2008-09, respectively. Whereas, during 2009-10 the production (3052.52 q) was slightly lower than the year 2008-09. After 2011-12, the barley seed indents and production, showed downward trends from 2012-13 and 2013-14. This decline was observed due to the lower indents

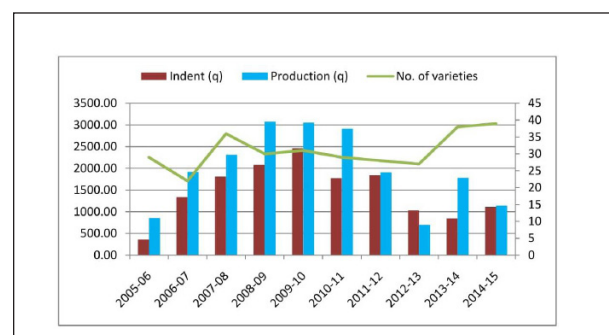
were placed by Rajasthan and Uttar Pradesh states. Even 90 per cent lower seed indents were placed from Uttar Pradesh during 2012-13 and 2013-14, respectively. The lower seed replacement rate (SRR), decline in area under barley cultivation, rise in irrigation facilities, NFSM covered crop cultivation etc. may be the reasons for this seed indent decline. During 2013-14 and 2014-15, 1782.64 q and 1141.16 q breeder seed was produced against the allocation of 843.10 and 1111.75 q for 38 and 39 varieties, respectively (Anonymous, 2014; 2015). After analysis of past 10 years data it was observed that every year surplus seed was produced against the indented quantity, except the year 2012-13. The reason for this declined production was due to the breeder seed demand was curtailed in Rajasthan state by the indenting agency for major indented varieties *i.e.* RD 2035, RD 2052, RD 2552 etc., after placing higher indents.

**Table 1.** Past ten years barley breeder seed allocation and production trends

Year	Allocation (q)	Production (q)	No. of varieties
2005-06	360.55	851.61	22
2006-07	1339.05	1915.50	22
2007-08	1688.65	2316.83	35
2008-09	2040.75	3077.79	29
2009-10	2464.50	3052.52	30
2010-11	1777.70	2912.18	28
2011-12	1841.60	1905.80	28
2012-13	1029.20	698.25	27
2013-14	843.10	1782.64	38
2014-15	1111.75	1141.16	39

The consolidated breeder seed indent of 862.45 q was received for ten states (Rajasthan, Uttar Pradesh, Uttarakhand, Haryana, Madhya Pradesh, Punjab, J&K, Sikkim, Jharkhand and Himachal Pradesh), two public sector corporations (State Farm Corporation of India and National Seeds Corporation) and private agencies during 2013-14. The major proportion of the breeder seed indent was from SAI (328.25 q) followed by Rajasthan state (312q), State Farm Corporation of India, New Delhi (59 q), Madhya Pradesh (40 q) etc. A total breeder seed for production of 843.10 q for 38 varieties was allocated for production at 10 seed producing centres over seven states. A net production of 1782.64 q breeder seed against allocated varieties was reported, which was surplus (939.54 q) in comparison to the allocated quantity. The maximum production was observed for the variety

The number of indented barley varieties ranged from 22 to 39 from 2005-06 to 2014-15. During 2012-13, allocation was made for 1029.20 q breeder seed of 27 varieties, which included requirement of seven states (Rajasthan, Uttar Pradesh, Uttarakhand, Haryana, Madhya Pradesh, Punjab and Himachal Pradesh), two public sector corporations (State Farm Corporation of India and National Seeds Corporation) and private agencies. The major proportion of the breeder seed indent was from Rajasthan state (45.53 %) followed by SAI (36.28 %), State Farm Corporation of India, New Delhi (7.28 %), Uttar Pradesh (3.06 %) etc. A net production of 698.25 q breeder seed of all the allocated varieties was reported, which was deficit (330.95 q) in comparison to the allocated quantity. This deficit seed production was mainly due to SKRAU, Bikaner centre curtailed breeder seed production programme for the major indented varieties *viz.* RD 2035, RD 2052, RD 2503, RD 2552 and RD 2668 after receiving communication from the indenting agency *i.e.* Rajasthan State Seed Corporation Limited (RSSCL). The maximum production was observed for the variety RD 2035 (125 q) followed by RD 2715 (100 q), RD 2592 (90 q), DWRUB 52 (76.80 q), BH 393 (60 q), RD 2660 (55 q), BH 902 (50 q), PL 426 (50 q), DWRB 73 (40 q), DWRUB 64 (64 q) etc.



**Fig. 1** Barley breeder seed indent and production trends (2005-06 to 2014-15)

RD 2552 (370 q) followed by RD 2035 (307 q), RD 2715 (224 q), RD 2660 (180 q), RD 2592 (100 q), PL 426 (81 q), RD 2052 (80 q), BH 393 (60 q), DWRUB 52 (59.67 q) etc. During 2014-15, an indent of 1114.45 q breeder seed of 41 varieties was received from nine states *viz.* Haryana, Himachal Pradesh, Madhya Pradesh, Meghalaya, Punjab, Rajasthan, Sikkim, Uttarakhand and Uttar Pradesh and National Seeds Corporation and Seed Association of India. The major portion of the indent was given by SAI (36.02 %) followed by Rajasthan (31.59 %), Uttar Pradesh (17.15 %), NSC (7.45 %) and Madhya Pradesh (5.65 %).

A total of 1111.75 q breeder seed of 39 varieties was allocated to 12 producing centres spread over seven states. The highest indent was placed for the variety RD 2660 (238.0 q) followed by DWRUB 52 (105.0 q) and PL 426 (95.65 q), while the old varieties namely Dolma (0.30 q), HBL 87 (0.40q) and BH 75 (0.40 q) were indented in very less quantities.

Due to adverse climatic conditions especially during crop maturity (untimely heavy rainfall and hailstorms), a deficit seed production was reported in some of the varieties. On the other hand, surplus production was also reported in some varieties viz. PL 426 (41.50 q), RD 2052 (41.90 q), RD 2552 (57.20 q), RD 2592 (16.0 q), RD 2624 (11.2 q), RD 2715 (23.0 q), RD 2786 (60.0 q), HUB 113 (36.8 q), NDB 940 (11.8 q) etc. For last three years (2012-13 to 2014-15) major indented varieties are presented in table 2. The data of table 2 depicted that the considered varieties

occupied 86.88, 83.48 and 91.10 per cents of the total indent during last three years, respectively. Whereas, these varieties also contributed 89.12, 89.18 and 87.96 per cents of the total production from 2012-13 to 2014-15, respectively. From the major varieties it was exhibited that the few varieties viz. PL 426, RD 2052 and RD 2035 were released prior to 2000, while most of the indented varieties are modern adaptable high yielding varieties. Out of these above mentioned varieties, the indents for RD 2052 and RD 2035 have been decreased, while for PL 426 the indent trend was stable. It was apparent that the newly released varieties viz. BH 946 (NWPZ), DWRB 91 (NWPZ), HUB 113 (NEPZ) and RD 2786 (CZ) were also indented and certainly replaced old varieties. In general, the indents for the varieties viz. BH 393, DWRUB 52, PL 426, RD 2035, RD 2592, RD 2660 and RD 2715 were higher during 2012-13 to 2014-15.

**Table 2.** Three years breeder seed indents and production of major varieties (2012-13 to 2014-15)

Varieties	Year	Production zone/state	Use type	2012-13		2013-14		2014-15		% change in indent over 2012-13 and 2014-15
				Indent (q)	Production (q)	Indent (q)	Production (q)	Indent (q)	Production (q)	
BH 393	2002	Haryana	Feed	59.50	60.00	57.40	60.00	62.70	63.00	5.4
BH 902	2010	NWPZ	Feed	49.95	50.00	26.30	27.00	23.20	24.00	-53.6
BH 946	2014	NWPZ	Feed	-	-	-	-	52.80	52.80	-
DWRUB 52	2007	NWPZ	Malt	76.80	83.75	55.00	59.67	105.00	59.56	36.7
DWRB 91	2013	NWPZ	Malt	-	-	6.35	7.90	29.40	23.35	-
HUB113	2014	NEPZ	Feed	-	-	-	-	23.20	60.00	-
JB 58	2005	MP	Feed	6.70	8.50	17.00	56.24	41.00	32.40	511.9
NDB 943	2009	Uttar Pradesh	Feed	9.00	-	11.70	12.00	48.20	17.50	435.6
NDB 1173	2005	NWPZ/NEPZ	Feed	9.00	-	7.20	22.00	30.20	27.00	235.6
PL 426	1996	Punjab	Feed	88.15	50.00	80.75	81.00	95.65	137.15	8.5
RD 2035	1994	NWPZ	Feed	176.40	125.00	76.90	307.00	89.60	93.00	-49.2
RD 2052	1991	Rajasthan	Feed	70.00	-	32.90	80.00	34.10	78.00	-51.3
RD 2552	2000	NWPZ/NEPZ	Feed	111.70	-	8.80	370.00	2.80	60.00	-97.5
RD 2592	2004	Rajasthan	Feed	75.00	90.00	10.00	100.00	20.00	36.00	-73.3
RD 2660	2006	NWPZ	Feed	65.00	55.00	110.00	180.00	238.00	40.00	266.2
RD 2715	2009	CZ	Feed	97.00	100.00	192.50	224.00	67.00	90.00	-30.9
RD 2786	2013	CZ	Feed	-	-	11.00	3.00	50.00	110.00	-
Per cent of total indent/production				86.88	89.12	83.48	89.18	91.10	87.96	

After considering past ten years indent and production trends, it was observed that the seed indents during 2014-15 were three folds higher than 2005-06, while the production was increased by 34 per cent over 2005-06, respectively. During 2014-15, the placed indents were higher of 7.42 and 24.16 per cents over the previous years i.e. 2012-13 and 2013-14, respectively. The number of indented varieties ranged from 22 to 39 in barley breeder

seed chain. On the basis of last three years, it was depicted that the seed indents for six-row feed barley varieties namely RD2660 and JB58 were increased tremendously i.e. two and five times, respectively. Similarly, the indents of salinity/alkalinity and hullless varieties namely NDB1173 and NDB943 were also increased two and four times, respectively. An increase of 36.7 per cent was also exhibited for two-row malt barley variety

DWRUB 52, whereas, another malt barley variety DWRB 91 also became popular during 2014-15 and 2015-16 and indented in higher quantities.

The rainfed barley variety RD 2660 showed increase during 2012-13 (65.00 q), 2013-14 (110.00 q) and 2014-15 (238.00 q), respectively. It is anticipated that in NWPZ, in future newly released malt barley varieties *i.e.* DWRB 92 and DWRB 101 (both timely sown) and DWRB 91 (late sown) will find still higher places in indent due to their better malting quality and raw material demand of brewing and malting industries. It is also expected that due to low water availability in the drier regions with shortage of green fodder the dual purpose variety RD 2715 would also be demanded in higher quantities. In near future, the newly released high yielding and disease tolerant varieties *i.e.* BH 902, BH 946, BH 959, BHS 400, DWRB 101, HUB 113, RD 2849 etc. will find higher places in indents and will ensure higher productivity and industrial demand.

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