

IARI BEST PRACTICE

1. Title of the Practice

BREEDING HIGH YIELDING AND WIDELY ADAPTED VARIETIES OF LENTIL AND CHICKPEA

2. Objectives of the Practice

Lentil is cultivated by small and marginal farmers as rainfed crop in Central India. It is grown on residual moisture of rainy season. The crop suffers from terminal moisture stress. Early maturity of about 100 days can help this crop in escaping terminal moisture stress. Bold seed size is another essential requirement of lentil. However in Eastern and Northern India, medium bold to small seeded types are preferred.

Chickpea (*Cicer arietinum* L.) is a rich source of nutrition and is ranked second amongst food legumes after common bean as far as its production is concerned. It is a self-pollinated diploid crop with genome size 740 Mbp (Varshney et al., 2013), $2n = 2x = 16$ and is grown extensively in about 57 countries under varied environmental conditions. Globally it is grown in an area of 13.72 million hectares (M ha) with an annual production of 14.25 million tons (MT) (FAOSTAT, 2020). South and South-East Asia dominate in chickpea production with 80% of regional contribution. The single largest share of chickpea production (65%, 9.0 MT) is held by India, followed by Australia (14%) in total world production (Merga et al., 2018). To attain self-sufficiency by 2050, the total pulse production in the country needs to reach 39 MT (Vision 2050, IIPR) and amongst all pulses, chickpea production alone needs to reach about 16 to 17.5 MT from a limited area of about 10.5 m ha with an average productivity of 15–17 q/ha.

3. The Context

The current lentil production is 1.49 mha. To meet the domestic demand nearly 0.8 mton of lentil import is necessary. Since horizontal expansion is difficult due to competition from other rabi crops it is essential to breed high yielding and early maturing varieties. The demand is for new varieties with early maturity.

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4. The Practice

L 4717: Notified and released in 2017. Recommended for Central Zone comprising states of Madhya Pradesh, parts of Uttar Pradesh and Rajasthan and Chhattisgarh. Suitable for timely planting under rainfed conditions in Central Zone for Rabi season. Average yield is 12-13 q/ha. L 4717 is resistant to powdery mildew disease and moderately resistant to fusarium wilt and ascochyta blight. It exhibited earliness, with mean **maturity 100 days** (over years and locations). **Biofortified with Fe concentration of 65ppm.**

L 4727: Notified and released in 2018. Recommended for Central Zone comprising states of Madhya Pradesh, parts of Uttar Pradesh and Rajasthan and Chhattisgarh. Suitable for timely planting under rainfed conditions in Central Zone for Rabi season. The average yield is 11.5 to 14.5 q / ha. Exhibited yield superiority of 23.7 percent over the best check IPL 316. **Mean**

maturity duration is 103 days. Moderately resistant to wilt in Central Zone. Seed size is bold with 100 seed weight of 3.1gm.

L 4729: Notified and released in 2020. Recommended for Central Zone comprising states of Madhya Pradesh, parts of Uttar Pradesh and Rajasthan and Chhattisgarh. Suitable for timely planting under rainfed conditions in Central Zone for Rabi season. Bold seeded variety with attractive seed coat colour. Extra early variety maturing in 103 days. Moderately resistant to wilt in Central Zone. Seed size is bold with 100 seed weight of 3.2 gm.

PDL-1 (Pusa Avantika): It has been released for cultivation under salinity conditions in Haryana and Uttar Pradesh. PDL-1 yielded on an average of 983.1 kg/ha under salt stress environment. It is also lodging tolerant besides tolerances to drought and heat stresses. Moreover, it is also, resistant to various diseases and pests like fusarium wilt, rust, powdery mildew, stemphylium blight, pod borer and aphids. Its maturity duration is around 111 days under salt stress and 140 days under normal conditions.

PSL-1 (Pusa Yuvraj): PSL-9 is recommended for Haryana and Uttar Pradesh for salinity stress situation (ECe 6.0 dS/m). It has yielded on an average of 949.5 kg/ha under salt stress environment This variety is also disease and pest resistant. PSL-9 matures in around 112 days under salt stress and 130 days under normal conditions.

Chickpea

1. **Pusa Vijay (BGM 10-217):** The variety has been recently identified and released in UP by UP SVRC for UP and adjoining areas. It is timely sown desi variety with ability to withstand drought and has an yield advantage of 10.83 percent over checks with yield potential of

2.7t/ha and average yield of 2.1t/ha with high degree of resistance to fusarium wilt and drought.

- BG 4005:** Pusa 4005 is a marker-assisted backcross breeding (MABB) derived drought tolerant introgression line of desi chickpea variety Pusa 362 possessing “QTL hotspot” region conferring drought tolerance. It recorded an overall weighted mean yield advantage of 18.8 % over the best national check (JAKI 9218) with an overall weighted mean yield of 1618 kg/ha and has an yield potential of 1940 kg/ha under drought conditions in north western plain zone (NWPZ) for which it has been identified. It is highly resistant to Fusarium wilt and stunt and moderately resistant (MR) to Dry root rot, collar rot and Botrytis Gray Mold. It has medium bold seed size (100-seed weight of 22.4 g) and protein content of 17.17 %.

- Pusa Chickpea 20211 (Pusa Chickpea Manav):** It is a MABC derived wilt resistance introgression variety of

chickpea developed using the recurrent parent “Pusa 391” possessing introgression of “QTL region” for wilt resistance on LG 2 having

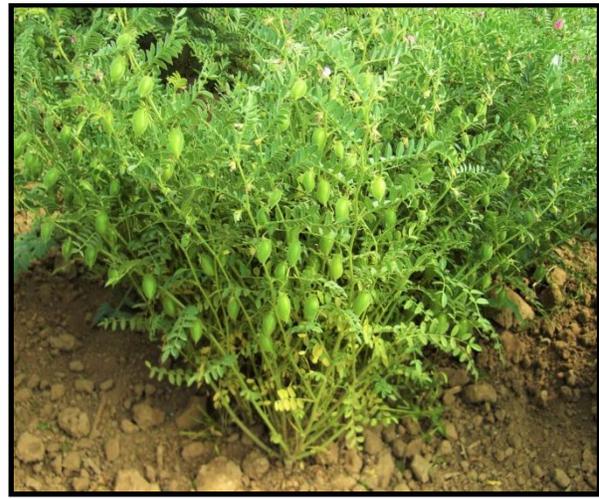


QTLs 1,3,4 & 5 from WR 315. The variety has been released for Central India in 2020 by Central Variety Release Committee (CVRC), Department of Agriculture and Farmers Welfare (DACFW), Government of India for Central Zone comprising of *Central Zone (CZ)* comprising of Madhya Pradesh, Chattisgarh, Maharashtra, Gujarat and Bundelkhand region of

Uttar Pradesh the largest chickpea production zone in world. It recorded an overall weighted mean yield advantage of 28 % over recurrent parent Pusa 391 across all the centers tested in National WRIL Trials under AICRIP over two consecutive years across central zone of testing namely, *Rabi* 2018-19 (25 % over Pusa 391 over six locations) and *Rabi* 2019-20 (30 percent over Pusa 391 over five locations). It has an overall weighted mean yield of 2392 kg/ha and has an yield potential of 3915 kg/ha under wilt stress conditions over the recurrent parent Pusa 391 which yielded 1877 kg/ha. Pusa Chickpea 20211 (Pusa Chickpea Manav) gave an average yield of 2533 kg/ha in AVT II which is more than even the commercial national check means of Aviz., JAKI 9218 (1865 kg/ha), JG 16 (1878 kg/ha), and Indira chana-1 (1526 kg/ha) giving 35.8%, 34.9% and 66 % respectively. It has an excellent grain color, size and shape. Its average 100-seed weight is 19.5g. It is highly resistant to *Fusarium* wilt, moderately resistant to dry root rot, collar rot and stunt.

4. **Pusa Chickpea 10216.** It is the **Country's first drought tolerant desi chickpea variety developed through Marker Assisted Backcross Breeding Programme** introgressing the root QTLs for drought from ICC 4958 into Pusa 372. The variety has been released for Central India in 2019 by Central Variety Release Committee (CVRC), Department of Agriculture and Farmers Welfare (DACFW), Government of India for Central Zone comprising of *Central Zone (CZ)* comprising of Madhya Pradesh, Chattisgarh, Maharashtra, Gujarat and Bundelkhand region of Uttar Pradesh the largest chickpea production zone in world. It recorded an overall weighted mean yield advantage of 16 % over recurrent parent Pusa 372 across all the centers tested in National DTIL Trials under AICRIP over two consecutive years across central zone of testing It has an average yield of 1475 kg/ha and an

yield potential of 2575 kg/ha under drought stress conditions. It is an early flowering and early maturing variety. It flowers in about 50-55 days and its duration is about 106 days. It has an excellent grain color, size and shape. Its average 100-seed weight is 22.2 g with grain protein content of 22.6 per cent.



5. **Pusa Parvati:** It was released for cultivation in Central India in 2019 comprising states of Madhya Pradesh, Maharashtra, Gujarat, Chhattisgarh and parts of Rajasthan. It is moderately resistant to Fusarium wilt, dry root rot and stunt. It is an erect desi chickpea variety suitable for machine harvesting and gives an average grain yield of 2.27 t/ ha in 112 days.

6. **Pusa 3043:** Desi chickpea variety released and notified (Central varieties) for release in 2018 for North East Plain zone of India comprising eastern UP, Bihar, Jharkhand, West Bengal, Assam. It is notable to mention that this is the first chickpea variety identified since last 15 years to this all-important zone. It has a breeder seed demand of 300q for 2020-21. It is suitable for late season planting and a short duration variety fitting into rice chickpea crop rotation of this area.

7. **Pusa 3022:** It is an extra large seeded kabuli chickpea variety released in 2016 for North West Plain zone Punjab, Haryana, Western Rajasthan, Haryana, Western UP and Delhi released and notified by Central Variety Release Committee, Government of India. Extra bold seeded variety with 100 seed weight of 37 g and having aschochyta blight and wilt tolerance. High yield potential recorded in NWPZ of 3056 kg/ha. Mean yield superiority of 14.4 % over the best check JGK 1. Developed through desi x kabuli introgression. Extra-large, attractive beige coloured seeds with 24% protein.

Uniqueness of varieties

| Variety | Characteristics |
|---------|---|
| L 4717 | Early maturity, medium bold seed size and rich in grain Fe concentration (Biofortified) |
| L 4727 | Early maturity and bold seed size |
| L 4729 | Early maturity and bold seed size |
| PDL 1 | Tolerance to salinity |
| PSL 9 | Tolerance to salinity |

Chickpea:

| | |
|---|--|
| Pusa Vijay (BGM 10-217) | A very high yielding chickpea variety released for UP |
| BG 4005 | MABC variety for drought tolerance developed in 2022 for NWPZ of Rajasthan, Haryana, Punjab, Delhi |
| Pusa Chickpea 20211 (Pusa Chickpea Manav) | Marker Assisted pyramided variety released in 2021, 1in breeder seed production chain now and is highly tolerant to wilt released for Central Zone |
| Pusa Chickpea 10216 | MABC variety for drought for Central zone and gives assured yield under dry conditions |
| Pusa Parvati | First mechanical harvesting line for Central Zone |
| Pusa 3043 | a very high yielding variety for NEPZ with tolerance to BGM |
| Pusa 3022 | Bold seeded kabuli chickpea variety for NWPZ |

5. Evidence of Success

L 4717 is leading lentil variety of country with highest breeder seed indent during 2020-21 and 2021-22.

| Variety | Breeder seed indent (Qtls) | | | | |
|-----------|----------------------------|-------|-------|-------|-------|
| L4717 | 20.0 | 20.15 | 33.90 | 58.86 | 63.0 |
| L4727 | | 7.0 | 8.0 | 10.0 | 22.07 |
| L4729 | | | | 12.0 | 17.6 |
| PDL1 | | | | | 0.52 |
| PSL 9 | | | | | 0.50 |
| Pusa 3043 | | | | 113 | 82.0 |
| BGD 111-1 | | | | 5.0 | 36.5 |
| Pusa 3022 | | | | 51.6 | 20.0 |

6. Problems Encountered and Resources Required

These varieties are Centrally released and states have a little tendency to promote their own released varieties. The FLDs and KVK support to popularize these varieties is required.

Technology dissemination is key for enhancing the lentil and chickpea productivity. To disseminate new varieties FLD are being conducted by NSC.

| FLD conducted by NSC | | | |
|----------------------|---------|------|----------------------|
| State | Variety | Year | No of FLDs conducted |
| MP | L 4717 | 2016 | 10225 |
| | L4727 | 2018 | 2500 |
| UP | L4717 | 2016 | 3606 |
| Rajasthan | L4717 | 2016 | 6500 |