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Notification and germplasm registration

Pearl Millet

Variety Punjab Composite Bajra 166 (PCB 166)

Punjab Composite Bajra 166 is a dual purpose bajra variety of Pearl millet [*Pennisetum glaucum* (L) R. Br.] developed by Forage, Millets and Nutrition Section, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana. It was released in Punjab State by the State Variety Approval Committee in February, 2022. PCB 166 has been released and notified by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties of Agricultural Crops, Department of Agriculture, Cooperation & Family Welfare, Government of India, New Delhi vide Notification number S.O. 1056 (E) dated March 6, 2023 for cultivation in the state of Punjab. The composite PCB 166 was developed from chain crossing of eight inbreds/ populations having tall plant height, high biomass and grain yield, which can be grown as fodder as well as grain crop. PCB 166 was tested against national check (Giant Bajra) in Initial Varietal Trial (IVT PM) under All India Coordinated Pearl Millet Improvement Project (AICPMIP) in *kharif* 2020 at the national level where it ranked second with a superiority of 12.8% for green fodder yield against the national check. At the zonal level PCB 166 ranked second in South zone with superiority of 5.9%; fourth in Central zone with superiority of 25.9%; and fifth in North West zone with superiority of 8.1% than the national check (Giant Bajra) for green fodder yield. Based on the performance at National level PCV 166 (FBL 4) has been identified in 2023 for release in North West and South zones of India. At Ludhiana PCB 166 gave 604.1q/ha and 117.2q/ha green fodderyield and dry matter yield with a superiority of 39.4 and 45.4 per cent, respectively than the check variety Giant Bajra. In the Punjab state, on the basis of overall mean (including both research & adaptive trials), PCB 166 recorded green fodder yield of 721.7q/ha against 649.1q/ha of check variety PCB 165. For grain yield, PCB 166 (40.9q/ha) showed a superiority of 22.9 % against the check variety PCB 165 (33.3q/ha). In Research trials conducted in Punjab state, PCB 166 gave 785.6 q/ha green fodder yield with a superiority of 12.3 and 29.4 % than the local check varieties PCB 165 and FBC 16, respectively. Similarly for dry matter yield, PCB 166 (121.8q/ha) recorded a superiority of 8.6 and 37.9 per cent against the check varieties PCB 165 and FBC 16, respectively. In the research trials, PCB 166 gave a grain yield of 43.1q/ha with a superiority of 20.8per cent than the check variety PCB 165 and also recorded stover yield of 236.1q/ha with superiority of 7.5 %. In the agronomic trials, PCB 166 showed responsiveness to nitrogen fertilizer as with the increase in dose of nitrogen the green fodder yield, dry matter yield and plant height increases.

The fodder quality of PCB 166 is found superior to the check varieties for nutritional (crude protein) and anti-nutritional (acid detergent fibre and neutral detergent fibre) components. PCB 166 has a very good crude protein i.e. 8.5 % against check varieties PCB 165 (7.6%) and FBC 16 (5.9 %). The in vitro dry matter digestibility (IvDMD) of PCB 166 is 47.8 % which is superior to PCB 165 (45.6%) and FBC 16 (41.9%). On the basis of digestibility of nutrients (on % basis) in metabolic trial, PCB 166 recorded significantly higher dry matter, crude protein and total digestible nutrients than the check variety PCB 165.

PCB 166 is a tall, late maturing composite variety with more number of tillers. It's average plant height is 282 cm. It gives fodder for longer duration as the 50% flowering comes after about 89 days of sowing. It possesses good fodder quality especially the crude protein and in-vitro dry matter digestibility. On an average, it gives 721.7 q/ha of green fodder and 236.1 q/ha of stover yield at maturity. As a grain crop, it matures late and takes 124 days to physiological maturity. It bears long cylindrical ears with average ear length of 63.8 cm. The grains are soft and slate in colour. On an average, it gives 40.9 q/ha of grain yield. It is tolerant to all the major diseases of bajra. Owing to its better fodder and grain yield and quality, is this variety preferred by the farmers of the Punjab state.

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Bt cotton

Variety ICAR-CICR 21 Bt

Since its commercialization in 2002, Bt cotton has been widely adopted in India, leading to a decrease in insecticide use against bollworms and contributing to increased cotton production. This innovative technology was initially offered to Indian cotton farmers exclusively through Bt hybrids, aiming at recurrent revenue generation. Despite India's leading position in cotton acreage and production, its productivity lags behind other major cotton-producing nations, partly due to the limited adaptability of Bt technology in hybrids to India's rainfed agro-ecologies. To enhance productivity, there is a call for the development and deployment of Bt varieties tailored to rainfed ecologies, which could elevate yield levels in India. In this regard, development of Bt variety ICAR-CICR 21 Btwas initiated at ICAR-Central Institute for Cotton Research (ICAR-CICR) during 2006-07. The genotype CNDTS21 was crossed with Bikaneri Narma Bt (cry1Ac with Mon531 event) and the resultant F1 was backcrossed with the recurrent parent (CNDTS21) three times and forwarded for five generations to develop homozygous lines of Mon531 event. During the process of backcrossing, the Bt introgression was monitored using enzyme-linked immunosorbent assay (ELISA). Based on its superior performance in ICAR-AICRP on Cotton trials conducted during 2018-19, 2019-20 and 2020-21, this entry (ICAR-CICR 21 Bt) was identified for release in 87th meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops held on 22nd September and 18th October, 2021 under the Chairmanship of DDG (Crop Science), ICAR. This variety was recommended for commercial cultivation under rainfed conditions of central zone comprising the states of Maharashtra, Madhya Pradesh and Gujarat through gazette notification [vide S.O. 8(E). dated 24th December 2021 (S. No. 312)].

The variety ICAR-CICR 21 Bt has recorded mean seed cotton yield of 997 kg/ha based on the 3 years (5 locations in 2018-19, and 4 locations each in 2019-20 and 2020-21) of testing in AICRP on Cotton in central zone. It recorded a potential yield of 2715 kg/ha at Nagpur during 2019-20. The zonal non-Bt check and zonal Bt check and local check recorded seed cotton yield of 956, 948 kg/ha and 1053 kg/ha, respectively. It recorded 804 kg/ha seed cotton yield in 2020-21 when tested under closer spacing and ranked first while the zonal non-Bt check, zonal Bt check and local check recorded seed cotton yield of 773, 716, and 769 kg/ha, respectively. At closer spacing, it recorded 4.01, 12.29 and 4.41 per cent increase over the zonal non-Bt check, zonal Bt check and local check, respectively. Yield superiority of 26.80, 25.44, and 19.36% was observed in 2019-20 over the zonal non-Bt check, zonal Bt check and local check, respectively, at normal spacing. It recorded over all yield superiority of 4.28% and 5.16% over zonal non-Bt and Bt check under normal spacing. It has lint index 4.2 (g) which is at par with the zonal non Bt check and local check. It recorded mean ginning outturn (GOT) of 34.9% with potential GOT of 36.9%. It possesses better fibre quality with fibre length of 27.17 mm, micronaire of 4.27 µg/in, bundle strength of 27.8g/tex which is at par to the local and zonal checks. It combines good tolerance to pest and diseases. It recorded a highest cry protein expression of 8.92ppmin leaf at 60 days after sowing.It produced bollworm (*Helicoverpa armigera*) mortality of 99%. Duration of this Bt variety is 150 to 160 days. This new Bt cotton variety with an option of high-density planting can help the cotton farmers in the rainfed regions of the central zone to achieve higher yields.

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Variety ICAR-CICR 25Bt

Cotton holds significant economic importance both in India and globally. India, contributes to 37% of the worldwide cotton area and 20% of its production. Approximately 60 million individuals in India rely on cotton cultivation, marketing, processing, and exports for their livelihoods, directly benefiting 6 million farmers. The predominant cultivation of upland cotton (*Gossypium hirsutum*) in India, chosen for its superior yield potential, faces challenges despite being grown in hybrid form for enhanced productivity. The country's low and stagnant cotton productivity is exacerbated by changing rainfall patterns, particularly affecting rainfed ecologies where hybrids are more vulnerable to vagaries of climate change. Over 60% of cotton cultivation in India occurs under rainfed conditions, where issues such as low plant density and a mismatch between growth and fruiting patterns in contemporary hybrids contribute to reduced yields. The development of Bt varieties tailored for rainfed agro-ecologies could play a pivotal role in bolstering cotton productivity in India.In this regard, a research programme was initiated during 2006-07

at ICAR-Central Institute for Cotton Research (ICAR-CICR), Nagpur, where an advanced breeding line CNDTS 25 was crossed with Bikaneri Narma Bt as transgene donor (cry1Ac gene, Mon531 event). A backcross breeding method was explored with three backcrosses, upon which pedigree method was followed to identify high yielding lines with Bt gene. The transgene introgression was traced through cry1Ac – ELISA during the backcrossing process.

The Bt variety ICAR-CICR 25 Bt was evaluated in ICAR-AICRP on Cotton trials for three years (2018-19 to 2020-21) across locations in south zone (Tamil Nadu, Karnataka, Telangana and Andhra Pradesh). The Bt variety ICAR-CICR 25 Bt was evaluated in conventional spacing at five locations in all the three years and in closer spacing (HDPS) at five locations in south zone during 2020-21. It recorded an overall mean seed cotton yield of 1575.68 kg/ha as against 1379 kg/ha recorded in non-Bt zonal check variety (Sahana). The potential yield of 2325 kg/ha was recorded at Mudhole location during 2020-21. The identified variety had a greater number of bolls per plant (22.9, 20.9, 16.1) than zonal check variety (18.3, 16.8, 14.9) and per square meter (68.1, 57.8, 68.6) during all the three years of testing and recorded higher bolls per square meter under the HDPS system (71.6). The duration of this variety is 150 to 160 days with mean ginning outturn of 35.4%. It has lint index of 4.37g and seed index of 8.37g. ICAR-CICR 25 Bt recorded a mean fibre length of 27.0 mm, micronaire of 4.0 µg/in, fibre strength of 26.4 g/tex and uniformity index 82.0% which is at par with the non-Bt zonal check variety and also other qualifying varieties. The identified variety ICAR-CICR 25 Bt was also found at par with the non-Bt zonal check for diseases and pest incidence. ICAR-CICR 25 Bt recorded cry protein level of 4.31 and 4.14 ppm in leaves at 90 and 60 days of crop during 2020-21. Mortality of 95 per cent was recorded in leaves up to 120 days after sowing. Presence of cry1Ac gene and Mon531 event was confirmed by gene and event specific PCR while homozygosity was ensured through zygosity PCR. This variety was identified in 87th meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops held on 22nd September and 18th October, 2021 and was gazette notified vide S.O. 8(E). dated 24th December, 2021 (S. No. 313). This new Bt variety can help in sustainable cotton production under rainfed ecologies of south India.

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4. Forage Sorghum

Variety SL 45

A single cut late maturing fodder variety SL 45 of sorghum [*Sorghum bicolor* (L.) Munch] was developed by Forage, Millets and Nutrition Section, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana. It was released in Punjab State by the State Variety Approval Committee in February, 2022. The variety, SL 45 has been released and notified by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties of Agricultural Crops, Department of Agriculture, Cooperation & Family Welfare, Government of India, New Delhi vide Notification number S.O. 1056 (E) dated March 6, 2023 for cultivation in the Punjab state. The composite SL 45 was developed from chain crossing of five populations having tall plant, late maturity and high fodder yield, and was tested in All India Coordinated Program in AICSIP during 2018-19 and 2019-20. This new composite SL 45 out yielded the national check CSV 32F for green fodder yield and dry matter yield by 10.3 and 11.5 per cent at the National level, whereas at zonal level (in Zone I) it out yielded the check CSV 32F by 9.5 and 8.6 per cent, respectively during *kharif* 2018. During *kharif* 2019, SL 45 was again evaluated in the AICSIP trials against the national checks (CSV 21F and CSV 30F). On the basis of overall mean (over the two zones), SL 45 recorded 8.3 and 9.8 per cent higher green fodder and dry matter yield respectively than the check variety CSV 30F and comparable yield to check variety CSV 21F. But at the zonal level i.e. in Zone 1, 13.1 and 16.4 per cent superiority for green fodder yield and dry matter yield against the national check variety (CSV 30F) was observed in SL 45.

In the Punjab state, on the basis of overall mean (including both research & adaptive trials), SL 45 recorded 687.8q/ha green fodder yield showing a superiority of 24.8 per cent against the check variety SL 44 with mean green fodder yield of 550.9 q/ha. In the research trials (over the years) SL 45 gave 725.5 q/ha and 166.7 q/ha green fodder and dry matter yield with a superiority of 33.5 and 41.5 per

cent, respectively then the local check variety SL 44 q/ha (543.5 and 117.8q/ha). In the agronomic trial, SL 45 showed responsiveness to nitrogen fertilizer as with the increase in dose of nitrogen the green fodder yield, dry matter yield and plant height increases. The fodder quality of SL 45 is superior with a crude protein of 8.75 per cent against check SL 44 (8.16 %). The *in vitro* dry matter digestibility (IvDMD) of SL 45 is also superior to the local check variety SL 44 by 1.8 per cent. On the basis of digestibility of nutrients (on % basis) in metabolic trial, SL 45 recorded significantly higher dry matter, crude protein and total digestible nutrients than the check variety SL 44.

This new variety SL 45 is a quick growing, tall, late maturing composite variety with more number of tillers. It'saverage plant height is 297 cm. It gives fodder for longer duration as the 50% flowering comes after about 99 days of sowing. On an average, it gives 687.8 q/ha of green fodder and 166.7 q/ha of dry matter yield at maturity. SL 45 possesses better fodder nutritional quality especially the crude protein and *in-vitro* dry matter digestibility with low HCN content. SL 45 is resistant to red leaf spot and moderately resistant to zonate leaf spot diseases. Owing to its better fodder yield and quality, it gained preference among the farmers of the Punjab state.

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5. waBerseem

Variety BL 45 (BM 12)

BL 45 is a new multi cut variety of Berseem (*Trifolium alexandrinum* L) developed by Forage, Millets and Nutrition Section, Department of Plant Breeding & Genetics, Punjab Agricultural University, Ludhiana. It was identified by Variety Identification Committee in the National Group Meet (Rabi) of All India Coordinated Research Project on Forage Crops and Utilization held on September 20, 2021 through virtual mode. The variety BL 45 was released and notified by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties of Agricultural Crops, Department of Agriculture, Cooperation & Family Welfare, Government of India, New Delhi vide Notification number S.O. 4065 (E) dated August31, 2022. This variety of Berseem is recommended for cultivation in Hill zone (Jammu & Kashmir, Himachal Pradesh and parts of Terai region of Uttarakhand); North West zone (Punjab, Haryana, Rajasthan, Uttarakhand) and Central zone (Uttar Pradesh, Madhya Pradesh, Maharashtra and Chhattisgarh) of India. BL 45 was developed through mutation breeding followed by selection, and a mutant line was tested for yield in All India Coordinated Program in AICRP (FCU) in winter season during 2018-19 to 2020-21. This new variety out yielded the national check Wardan for green fodder yield by 3.6, 13.7 and 11.5 per cent in Hill zone, North West zone and Central zone, respectively. On the basis of over all mean (over the threezones), BL45 recorded 11.2 per cent superiority for green fodder yield against the national check. Similarly, BL 45 out yielded the national check Wardan for dry matter yield by 8.4, 5.7 and 10.0 per cent in Hill zone, North West zone and Central zone, respectively. On the basis of overall mean (over three zones), BL 45 recorded 7.7 per cent superiority for dry matter yield against the national check Wardan. BL 45 recorded 50.9, 6.1 and 17.2 per cent higher per day productivity for green fodder yield than the national check variety Wardan in Hill zone, North West zone and Central zone, respectively. Similarly, 55.5, 3.7 and 4.3 per cent higher per day productivity for dry matter yield than the national check Wardan was recorded in Hill zone, North West zone and Central zone, respectively. BL 45 attains comparable plant height but bushy with comparatively better leaf:stem ratio and late flowering as compared to national check Wardan.

In agronomy trials, BL45 showed its superiority for green fodder yield (242.4q/ha) and dry matter yield (46.44q/ha) over the national check variety Wardan (233.4 and 43.83 q/ha), respectively and Zonal check BL 22 (228.3 and 43.93 q/ha), respectively in Hill Zone. BL45 also showed its superiority for green fodder yield (650.0q/ha) and dry matter yield (84.79q/ha) over the national check variety Wardan (559.9 and 71.72 q/ha), respectively and Zonal check BB 2 (568.2 and 73.01 q/ha), respectively in North West Zone. BL45 gave comparable results for green fodder yield (530.2q/ha) and dry matter yield (82.46q/ha) against the national check variety Wardan (529.1 and 79.42 q/ha), respectively and Zonal check BB 2 (532.6 and 81.86 q/ha), respectively in Central zone. On the basis of zonal mean (mean over the three zones), the berseem variety BL45 also recorded better green fodder yield (605.9q/ha) and dry matter yield (89.8q/ha) than the national check Wardan (544.7 and 83.1q/ha) with a superiority of 11.2 and 8.0 per cent, respectively. The variety BL45 also responded significantly to higher phosphorous doses for green fodder yield, dry matter yield as well as for crude protein yield.

The variety BL 45 showed better nutritional quality in terms of crude protein yield as it recorded 22.7, 9.8 and 10.8 per cent superiority than the national check variety Wardan in Hill zone, North West zone and Central zone, respectively. Over the three zones, BL45 recorded 16.6q/ha crude protein yield as compared to the national check variety Wardan (15.0q/ha) with a superiority of 11.3 per cent. BL 45 showed comparable reaction to lepidopteran insect (*Helicoverpa armigera*) and number of aphids per plant than the check varieties. BL 45 also showed resistant reaction to root rot in Hill zone and moderately resistant reaction to stem rot in North West Zone and Central zone. The salient features of this variety are high green fodder, dry matter yield and crude protein yield, better resistance to *Helicoverpa armigera*, and stem rot disease with better fodder nutritional quality. Owing to its higher fodder yield with better fodder quality, it is expected that this variety will gain preference among the dairy farmers in the states of Hill, North West and Centralzones of India.

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