

NANDYAL GRAM 452 (NBEG 452), A HIGH YIELDING *DESI* CHICKPEA VARIETY FOR ANDHRA PRADESH

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ABSTRACT

Nandyal Gram 452 (NBEG 452), a high yielding *desi* chickpea cultivar developed by Regional Agricultural Research Station, ANGRAU, Nandyal was notified during October, 2020 for commercial cultivation in Andhra Pradesh state. The variety has a yield potential of 2500 kg ha⁻¹ with a duration of 90 – 105 days. It is semi-spreading type with attractive pods and bold seeds having a test weight of 24-26 g and protein content of 20.5 %. This variety has gained attention of the farmers and it has potential to replace the old variety 'JG -11' and is expected to contribute for increase in chickpea productivity and net returns in farmers holdings.

Key words : Nandyal Gram 452, Seed yield, *Desi* chickpea

INTRODUCTION

Chickpea is the world's second most important food legumes; rich in protein (18%-22%) and also possesses fibre, vitamin B and minerals. India is the principal producer and consumer of chickpeas in the globe with cultivable area of 9.68 mha and 11.08 million tons of production and 1142 kg ha⁻¹ productivity (AICRP on Chickpea, 2021). The crop is grown in almost all parts of the country, mostly as a rainfed crop. Madhya Pradesh is the sole largest maker with 40% of total production. Rajasthan, Maharashtra, Karnataka, Uttar Pradesh and Andhra Pradesh contribute to 13%, 12%, 11%, 5% and 6%, respectively. In southern states, Andhra Pradesh has witnessed chickpea revolution during the

past decade. The chickpea area has increased from 1,46,000 ha in 1998-99 to 4,59,000 ha in 2019–2020. The major chickpea growing districts in Andhra Pradesh are Kurnool, Prakasam, Anantapur and Kadapa. Nearly 80% of the chickpea growing area of the state is in these four districts. Regional Agricultural Research Station, Nandyal, Kurnool district is the lead centre responsible for location specific research in scarce rain fall zone of Andhra Pradesh. The southern states of India are characterized by short and warm winters. Unlike traditional chickpea growing areas in the northern India, in case of southern states the duration of chickpea crop is short (90–120 days) and often suffers due to moisture stress. Crop

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improvement programmes at Regional Agricultural Research Station, Nandyal since 2004 have led to the development of high yielding chickpea varieties with traits suitable for cultivation in Andhra Pradesh. Nandyal Gram - 452, the recently released cultivar is a high yielding wilt resistant variety notified for cultivation in Andhra Pradesh during 2020. A brief note on the development of the variety and its performance in yield trials and in farmers fields is discussed in this paper.

MATERIALS AND METHODS

NBeG-452 cultivar is a selection from a cross of ICCV 37 x ICC 12451 varieties. The cross was made at ICRISAT and advance breeding line was supplied to RARS, Nandyal. Advance breeding line obtained from this cross was evaluated at research station as per the standard protocol of Acharya N.G. Ranga Agricultural University. The female parent of the cross, ICCV 37 is the high yielding variety known as 'Kranti' released during 1989. It has a test weight of 18 g. The male parent 'ICC 12451' is a semi erect plant type with a yield potential of 20 q ha⁻¹ and a test weight of 22 g. After its successful performance in station yield trials (2010–12) and AICRP trials (2013–15) and also in Andhra Pradesh state multi-location trials (2014–16), it was also tested for three years in farmer's fields as minikits (2016–19).

RESULTS AND DISCUSSION

The first step in the evaluation of promising lines in research station are initial and advanced varietal trials. In these trials, NBeG 452 recorded 1539 kg ha⁻¹ with a yield advantage of 19.0 % over the local check, JG - 11 (Table 1). Subsequently it was also tested in AICRP system during 2013–14. In AICRP trials of South Zone

conducted at four locations, NBeG 452 recorded 1946 kg ha⁻¹ of seed yield with yield advantage of 17.7 % over the check, JG 11 (1653 kg ha⁻¹). In AICRP trials of West Central Zone conducted at eight locations, the yield advantage (2127 kg ha⁻¹) recorded was almost same (17.2 %). In multi-location trials conducted in different districts of Andhra Pradesh during 2014-15 & 2015-16, this entry recorded yield superiority of 11.8 % and 18.5 %, respectively over the check JG 11. Furthermore, in AVT I (2014-15) of West Central Zone conducted at eight locations, NBeG 452 recorded 1694 kg ha⁻¹ with a yield increase of 15.2 % over the check, JG 315 (1471 kg ha⁻¹). Verma *et al.* (2019) reported that NBeG 452 was the most stable genotype over environments and suitable for breeding medium bold genotypes.

Agronomy trials of AICRP on chickpea tested at 6 centers under normal dates of sowing with recommended fertilizer doses (20 kg N + 50 kg P₂O₅), NBeG 452 recorded (1344 kg ha⁻¹) 15.6% yield advantage against the check JG 315 (1163 kg ha⁻¹). This culture's response to nitrogen application (Table 2) @ 20 kg ha⁻¹ (2205 kg ha⁻¹) and 40 kg/ha (2295 kg ha⁻¹) was on par

Table 2. Response of NBeG 452 to nitrogen application at RARS, Nandyal (2019-20)

Treatments	Seed yield (kg ha ⁻¹)	% increase over the check
N-level-3 (kg ha⁻¹)		
N₀: 0	1844	—
N₁: 20	2205	19.6
N₂: 40	2299	24.7
S.Em+	63	
C.D. @ 5%	186	

Table 1. Performance of NBEG 452 in yield trials in research stations

Year	Centre	Seed yield (kg ha ⁻¹)		% increase over check
		NBEG 452	JG 11 (Ch) / JG 315 (Ch)	
2010 – 2011 (Station trial)	RARS, Nandyal	1292	1085	
2011 – 2012 (Station trial)	RARS, Nandyal	1785	1501	
	Mean	1539	1293	19.0
2013 – 2014 (AICRP trial- IVT- South Zone)	Gulbarga	1595	1325	
	Nandyal	1973	1513	
	Bijapur	1652	1979	
	Lam	2562	1798	
	Mean	1946	1653	17.7
2013 – 2014 (AICRP trial- IVT- West Central Zone)	Badnapur	2420	1626	
	Junagadh	1934	1356	
	Rahuri	2048	1930	
	Sehore	2741	1821	
	Kota	2222	1979	
	Indore	3099	2942	
	Akola	918	1277	
	Mean	2127	1815	17.2
2014 – 2015 (Multi-location trials in Andhra Pradesh)	ARS, Tandur	2535	2474	
	ARS, Podalakur	1805	1515	
	ARS, Madhira	1581	1440	
	RARS, Nandyal	1957	1772	
	RARS, Lam	1890	1530	
	Mean	1953	1746	11.8
2015 – 2016 (Multi-location trials in Andhra Pradesh)	RARS, Nandyal	2066	2123	
	RARS, Lam	1974	1561	
	Mean	2095	1768	18.5
2014-15	Badnapur	1975	1392	
	Junagadh	1651	1367	

Table-1 Contd..

Year	Centre	Seed yield (kg ha ⁻¹)		% increase over check
		NBeG 452	JG 11 (Ch) / JG 315 (Ch)	
(AICRP trial-AVT I– West Central Zone)	Rahuri	2497	1969	
	Sehore	1380	1916	
	Kota	1500	1151	
	Indore	1914	1719	
	Akola	963	864	
	Banswara	1671	1390	
	Mean	1694	1471	15.2
2015 – 2016 AICRP Agronomy trial- Normal date of sowing with recommended N and P levels (20 kg N +50 kg P ₂ O ₅)	Junagadh	1022	1023	
	Rahuri	1694	1416	
	Akola	1087	1300	
	Badnapur	782	849	
	Kota	1740	1361	
	Sehore	1740	1027	
	Mean	1344	1163	15.6

Table 3. Performance of NBeG 452 in farmer's holdings (Minikits and On-farm trials)

S.No.	Year	Testing Centre	Seed yield (kg ha ⁻¹)		%increase over check
			NBeG 452	Localcheck	
1	2016 – 2017 Minikit – I st year	Kurnool, Prakasam and Kadapa districts	1446 + 226	1203 + 235	20.0
2	2017– 2018 Minikit – I st year	Kurnool, Ananthapuram and Kadapa districts	1473 + 75	1300 + 66	13.3
3	2018 – 2019 Minikit – I st year	Kurnool, Prakasam, Ananthapuramu, Kadapa and Guntur districts	1237 + 210	1075 + 164	15.1
4	2017 – 2018 On Farm trial	Kurnool and Ananthapuramu districts	1433 + 49	1245 + 46	15.1
5	2018 – 2019 On Farm trial	Kurnool, Prakasam, Ananthapuramu, Kadapa and Guntur districts	1358 + 91	1178 + 77	15.3

Table 4. Ancillary and Nutritional parameters of NBeG - 452

Ancillary traits	NBeG 452	JG 11	Nutritional traits	NBeG 452	JG 11
Days to 50 % flowering	46	45	Dal recovery (g kg ⁻¹)	740	748
Days to maturity	95	98	Broken dal (g kg ⁻¹)	81	52
100 seed weight (g)	26.1	22.0	Broken dal with seed coat (g kg ⁻¹)	79	43
No.of pods/plant	50.6	45.0	Husk (g kg ⁻¹)	100	157
			Dal recovery (%)	74	74.8
			Protein content (%)	20.5	20.0

Table 5. Reaction of NBeG-452 to major pests and diseases

Entry	Dry Root Rot (%)			<i>Fusarium</i> wilt (%)	<i>Helicoverpa</i> pod damage (%)	
	2013–14	2014–15	2015–16	2013–14	2014–15	2015–16
NBeG 452	2.38	22.9	1.30	10.2	19.1	5.80
Susceptible check	19.75 (L 550)	92.9 (L 550)	26.60 (L 550)	85.3 (JG 62)	33.0 (ICCV 3137)	28.4 (ICCV 3137)
Resistant / Tolerant check	2.19 (JG 315)	78.0 (JG 315)	15.20 (JG 315)	3.70 (JG 315)	16.6 (ICCL 86111)	6.0 (ICCL 86111)

Table 6. DNA fingerprinting of NBeG-452 and other popular varieties of chickpea

Marker	Parents of NBeG 452		Proposed variety	Popular varieties				
	ICC12451	ICCC37		NBeG 452	JAKI9218	JG 11	NBeG3	NBeG 47
ICCM0249	160	160	160	160	160	191	160	191
CASTMS11	229	229	229	229	229	229	231	229
NCPGR127	222	218	218	218	218	216	218	216
NCPGR21	164	143	147	147	147	149	149	149
GA24	200	200	200	200	200	200	202	200
TAA170	275	272	281	265	281	259	259	259
TR11	183	183	183	183	-	213	183	213

and significantly superior to no nitrogen application (1844 kg ha⁻¹). After its consistent superior performance in all the yield trials over the popular checks, it was proposed for minikit testing in different chickpea growing areas of Andhra Pradesh. Minikit testing of NBeG 452 in farmer's holdings recorded 20.0%, 13.3% and 15.1% superiority over the popular check, JG 11 during 2016-17, 2017-18 and to 2018-19, respectively. In large-scale demonstrations conducted during 2017-19 in farmer's holdings, its superiority was clearly evident as this entry recorded 1433 kg ha⁻¹ and 1358 kg ha⁻¹ seed yield which is 15.1% and 15.3% higher than the popular varieties grown by the farmers (Table 3).

Data on its ancillary characters (Table 4) over locations revealed that it has a test weight of 26 g and matures in 95 days with an average of 50 pods per plant. Its nutritional traits are also encouraging with low husk (100 g), good dal recovery (74%) on par with check variety (74.8%) and got attractive bold seeds with 20.5 % protein content. NBeG 452 is moderately resistant to *Fusarium* wilt (Table 5) and recorded significantly less dry root rot incidence and comparable in its performance with resistant check. It is also on par with tolerant check in its reaction to pod borer (*Helicoverpa armigera*).

DNA fingerprinting data (Table 6) for NBeG -452 genotype was generated at ICRISAT using seven SSR markers along with its parents (ICC12451 and ICCCV 37) and five popular cultivars (JG 11, JAKI 9218, NBeG 3, NBeG 47 and NBeG 49) grown in Southern India. Three markers (NCPGR127, NCPGR21 and TAA170) were found polymorphic between the parents and two markers (ICCM0249 and NCPGR127) could differentiate NBeG 452 from other popular

cultivars, NBeG- 3 and NBeG- 49. At least one marker was found polymorphic between NBeG 452 and the other popular varieties evaluated.

The line NBeG- 452 has been assigned with national identity, IC633789 by ICAR-NBPGR, New Delhi. The Central Sub Committee on Crop Standards, Notification and Release of Varieties has also notified this variety on 10th July, 2020 and the gazette notification of the Govt. of India published on 7th October, 2020 as S.O 3482 (E). Regional Agricultural Research Station, Nandyal centre has also sufficient stock seed and will be scaled up in the seed chain system in near future to fulfill the huge demand from farmers.

CONCLUSION

In Andhra Pradesh, more than 80 % of the chickpea cultivation is saturated with age-old short duration *desi* varieties JG 11 and JAKI 9218 and the development of Nandyal Gram - 452 (NBeG - 452) is a landmark in chickpea cultivation which is recommended as a better alternative to JG 11 and other *desi* varieties grown by farmers of Andhra Pradesh. It is a semi spreading type with medium plant height with a yield potential of 2500 kg ha⁻¹ recommended for cultivation as a rainfed crop and can also be grown with one or two irrigations in all the chickpea growing districts of Andhra Pradesh.

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