

Short communication

New variety horsegram (*Macrotyloma uniflorum* (Lam.) Verdc.) 'CRIDALATA' (CRHG-04) released for South India

P RAGHU RAM REDDY, V MARUTHI, K SALINI and DGM SAROJA

Central Research Institute for Dryland Agriculture, Hyderabad, Andhra Pradesh 500 059

E-mail: vmaruthi@crida.in

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ABSTRACT

Cridalata (CRHG-04) is a new promising [*Macrotyloma uniflorum* (Lam.) Verdc.] black seeded variety of horsegram developed by mutation breeding (γ rays irradiation) and released for south India in 2010. It matures in 85-95 days and yields in the range of 700 to 1100 kg/ha, has high pod number as well as synchronized brisk podding behaviour. The normal sowing period is August second fortnight to September end. However, with North East monsoon rains it can be sown even in October. This variety responds to fertilizer up to 20 N+40 P₂O₅ per ha and has 27.1 % protein content. The variety is black seeded and pods do not shatter, an important parameter which saves/conserves seed yield, when harvesting is delayed. It is tolerant to yellow mosaic virus, powdery mildew and mites. It recorded mean grain yield, of 785 kg/ha in farmers' fields, which is 34% higher over the local varieties. It's unique feature is that it can be grown purely under rainfed conditions with no inputs and ideal for small and marginal farmers especially confer household nutritional security. Apart from being a normal and late *kharif* / *rabi* dryland variety, it is also an excellent contingent crop and can serve as green cover when sown in early *kharif* which could be used for fodder along with being a cover crop for soil and water conservation in watersheds.

Key Words: Black seeded, Disease and pest tolerant, Horsegram, High yielding, Mutation, New Variety, Pod shattering, Yellow mosaic virus, Wide adaptability

Horsegram [*Macrotyloma uniflorum* (Lam.) Verdc.] is one of the traditionally grown tropical arid grain legume crop due to its greater adaptability to poor soils under adverse climatic conditions which are unsuitable to many other crops. Annual production is about 0.74 million tonnes from 1.7 million ha with a productivity of 494 kg/ha (Kumar 2007). Major states growing horsegram are Karnataka, Maharashtra, Odisha, Andhra Pradesh, Tamil Nadu and Kerala.

Horsegram is nutritious with high protein content and serves as a source of household nutritional security, especially for small and marginal farmers of dry tracts and is relished as a snack, after sprouting and is an important constituent of 'Sambhar', an important component of

southern dishes. Further it is a proven medical therapy for Kidney stones avoiding surgery and is a major ingredient of ayurvedic medicine 'CYSTONE' (Singla and Kanwar 1985), irregular menstrual periods and urinary problems, whooping cough, constipation, acidity and rheumatism *etc.* It is suitable as a cover crop in soil and water conservation especially in watersheds and an excellent drought tolerant contingent crop with delay in the onset of monsoon. Also introduction of horsegram as an intercrop in maize and as a sole crop was very successful in Western India (Witcombe *et al* 2008). The number of improved varieties is limited in horsegram (Kumar, 2007). As the varietal improvement in this crop, which had low variability, was negligent, mutation breeding was attempted to create variability and breed superior varieties. The breeding objective was to evolve an early, high yielding genotype tolerant to powdery mildew, anthracnose, mites and showing wide adaptability along with non-shattering pods.

Through physically induced mutation using γ rays irradiation 'Cridalatha' was evolved from 'local' variety. 'local' was a long duration variety with low yields, susceptible to yellow mosaic virus and pod shattering leading to loss of seed upon pod drying.

Breeding was done by pedigree selection through single plant from variability induced by the mutations. Various doses starting from 10Kr (Kilorads) to 35 Kr with an interval of 5Kr were induced in the seed of the source material with a lethal dose of 50% germination as the limit at 35Kr. A number of lines were developed through selections carried out from M₁ to M₆ generations. Since the line CRHG-04 (released in the name of 'Cridalatha') was found promising, it was entered into the All-India Multi-Local Trials of the National Network Research Project on Arid-Legumes and was promoted to next higher stages of testing from IVT 2004 to AVTI (Advanced Varietal Trial) in 2005 and finally to AVT-II during 2007 and 2008. In All-India trials conducted for four years, totaling 28 trials, were conducted with 4 replications in a RBD. Each plot contained 8 rows of 4 meter length at spacing of 30 x 10 cm. The trials were conducted under rainfed conditions with no-inputs of fertilizer and pesticides.

The yield components were determined on randomly taken 5 plants per plot while data on incidence of pests and diseases was recorded on plot basis. The data from various centres were collected and pooled analysis of the trials was carried out by the National Network Project on Arid Legumes center at CAZRI, Jodhpur, Rajasthan. Agronomy trials were conducted during 2007 at Hyderabad centre of National Network Project on Arid legumes to find out the appropriate sowing time, spacing and fertilizer response. At this centre, two dates of sowing viz. 25/8/2007 and 25/9/2007 along with two inter-row spacings viz., 30 cm and 45 cm and four fertilizer doses (0+0, 0+20, 10+20 and 20+40 of N + P₂O₅) were studied. These treatments were applied in a Split plot design.

Performance of CRHG-04

Grain and fodder yield and maturity period

In the All India trials conducted by National Network Research Project on Arid Legumes, 'Cridalatha', recorded 33.1% higher grain yield over the best All India check 'PHG-

9' from 2004 to 2008. The grain yield ranged from 615.3 to 1028.8 kg/ha (Table1).

Fodder Yield

Dry fodder yield showed 6.0% higher yield over the check 'PHG-9' and ranged from 68.5 to 1085 kg/ha (Table2). Maturity period in All-India trials ranged from 89 to 100 days with a mean of 95 days as compared to 93 to 98 days with a mean of 94 days for PHG-9' (Table 3).

Quality

The average protein content in 'Cridalatha' was 27.13% as compared to 27.04% in check PHG-9. The carbohydrate (%) of both the varieties were 51.0 showing the new variety to have similar quality as that of the check (Table4).

Diseases and pests

The disease and pest reaction trials showed Cridalatha to be tolerant to powdery mildew, yellow mosaic virus, anthracnose and mites (Table 5).

Table 1. Average performance (grain yield:kg ha⁻¹) of horsegram variety CRHG-04 along with checks AK-21,AK-42 and PHG-9 in the All India Coordinated Varietal trials during Kharif 2004 to 2008 in South India

Variety	2004 (7) IVT	2006 (7) AVT-I	2005 (6) AVT-II	2008(8) AVT-II	Overall Mean	Total Locations	% Superiority over check
CRHG-4	1028.8	615.3	665.0	829	84.5	28	--
AK21©	632.3	506.7	-	551	563.3	15	39.2
PHG-9©	512.2	387.7	688.0	770	589.4	24	33.1
AK-42©	-	419.8	415.0	626	487.0	21	61.1
Mean					606.0		
CD 5%					73.1		

Table 2. Average performance (fodder yield: kg ha⁻¹) of horsegram variety CRHG-04 along with checks AK21,AK-42 and PHG-9 in All India Coordinated Varietal Trials during Kharif 2004 to 2008 in South India

Variety	2004 (5)	2005 (4)	2006 (4)	2008(5)	Overall Mean	Total Locations	Taller over check (%)
CRHG-4	1023.0	810.8	685	1085	901.0	18	--
AK21©	707.1	929.8	-	977	871.0	10	3.4
AK-42 ©	-	568.3	518	1068	718.0	13	25.5
PHG-9©	1046.0	531.0	586	1236	850.0	15	6.0
Mean				835			
SE±					46		

Note: Number of locations is given in parentheses,

Source: Annual Progress Report, 2004-05, 2005-06, 2006-07 and 2008-09 of National Network Research Project on Arid Legumes (ICAR), CAZRI, Jodhpur.

Table 3. Days to maturity of horsegram variety CRHG-04 along with checks AK-21,AK-42 and PHG-9 in All India Coordinated Varietal Trials during Kharif 2004 to 2008 in South India

Variety	2004(5)	2005 (4)	2006(4)	2008(7)	Overall Mean	Total Locations	Days early/late over check
CRHG-4	89.4	96.2	100.0	95.0	95.1	19	--
AK21©	80.0	94.5	-	90.0	88.1	12	7.0 late
AK-42©	-	94.5	88.0	90.0	91.0	15	5.0 late
PHG-9©	92.7	93.0	94.3	98.0	94.5	16	on par
Mean					92.1		
SE ±					1.8		

Note: Number of locations are given in parentheses,

Source: Annual Progress Report, 2004-05,2005-06,2006-07 and 2008-09 of National Network Research Project on Arid Legumes (ICAR), CAZRI and Jodhpur.

Table 4. Crude protein content (%) of horsegram variety CRHG-04 along with checks AK21, AK42 & PHG-9 in All India Coordinated Varietal Trials during Kharif 2004 to 2008

Variety	2004(1)	2005(1)	2006(1)	2008(1)	Overall Mean	Total Locations	% Superiority over check
CRHG-4	24.50	31.38	27.64	25.00	27.13	4	--
AK-21©	22.31	30.21	28.17	27.30	26.99	4	on par
AK-42©	-	-	-	28.31	28.31	1	on par
PHG-9 ©	21.44	31.10	28.88	26.75	27.04	4	on par
Mean					27.36		
SE±					0.3		

Note: Number of locations are given in parentheses,

Source: Annual Progress Report, 2004-05, 2005-06, 2006-07 and 2008-09 of National Network Research Project on Arid Legumes (ICAR), CAZRI, Jodhpur.

Table 5. Reaction of Horsegram Variety CRHG-04 along with checks AK-21 and PHG-9 to major diseases and pests in Trials of All India Coordinated Research Project on Arid Legumes during Kharif 2004 to 2008

Variety	Powdery Mildew (4 Locations)					Yellow Mosaic Virus % (5 Locations)					
	2004 (1)	2005(1)	2006(1)	2008(1)	Mean	2004 (1)	2005(1)	2006(1)	2008(2)	Mean	
	Hyderabad*	Hyderabad*	Hyderabad*	Hyderabad*		Hyderabad*	Hyderabad*	Hyderabad*	Palem	Hyderabad*	
CRHG-4	0.0	1.0	0.8	1.4	0.8	1.0	1.0	2.1	0.0	1.4	1.1
AK-21©	0.0	2.0	1.5	1.2	1.2	-	1.0	1.5	55.8	2.4	15.1
PHG-9©	1.0	1.0	2.1	2.4	1.6	1.0	1.0	1.6	0.0	1.2	1.0
Mean					1.2						5.7
SE±					0.2						5.7

*1--5 Scale

Variety	Leaf Blight % (2 Locations)			Root Rot%(3 Locations)			Anthracnose(2 Locations)				
	2004(1)	2006 (1)	Mean	2004 (2)	Mean	2006(1)	Mean	2006(1)	2008 (1)	Mean	
	Bawal	Paiyur		Pattanambi	Bawal	Pattaambi		Hyderabad	Hyderabad		
CRHG-4	21.3	trace	10.6	0.3	9.7	5.0	3.2	4.1	0.7	2.6	1.6
AK-21©	17.2	trace	8.6	-	6.8	6.8	6.6	6.7	1.7	3.2	1.7
PHG-9©	6.8	trace	3.4	2.1	4.7	3.4	3.1	3.2	2.2	2.2	2.2
Mean			7.5			5.0		4.6			1.8
SE±			2.6			1.2		1.2			0.2
Variety	2004 (1)			Mites/3 Leaves			Mean				
				S. K. Nagar							
CRHG-4				3.35* (10.72)			3.35* (10.72)				
AK-21©				4.33* (18.25)			4.33* (18.25)				
PHG-9©				2.32* (4.88)			2.32* (4.88)				
CD 5%				3.72							
CV %				71.09							

Note: Number of locations are given in parentheses

* X + 0.5 transformed values & Figures in the parenthesis are retransformed value

Source: Annual Progress Report, 2004-05, 2005-06, 2006-07 and 2008-09 of National Network Research Project on Arid Legumes (ICAR), CAZRI, Jodhpur.

Agronomy

The normal date of sowing (second fortnight of August) at Hyderabad receiving SW monsoon resulted in grain yield of 788.9 kg/ha than that of delayed sowing (second fortnight of September) with a yield of 491.4 kg/ha showing a yield increase of 60.5% (Table 6). This was due to lack of sufficient rainfall in delayed sowing. Normal row spacing of 30 cm resulted in better yields in both dates of sowing with 725.3 kg/ha compared to that of wider row spacing of 45 cm with 555.0 kg/ha. Normal time of sowing with normal spacing and a fertilizer level up to 20N + 40 P₂O₅ gave the highest yield of 922.2 kg/ha followed by 10N + 20P₂O₅ with 875.5 kg/ha, 0N + 20P₂O₅ with 843.8 kg/ha as compared to check 0N + 0P₂O₅ (practiced by the farmers) with 796.6 kg/ha. This showed an increase of 15.8%, 9.9% and 5.9% respectively over the check 0N + 0P₂O₅. However

Table 6. Effect of Agronomic management (Sowing time, row spacing and fertilizer) on the seed yield of Horsegram variety CRHG-04 at CRIDA, Hyderabad during 2007 kharif

Treatments	Seed Yield(Kg ha ⁻¹)	Mean
Sowing Time		
1st Date(25/8/2007)	788.90	640.17
2nd Date(25/9/2007)	491.44	
CD at 5%	8.61	
Row Spacing(cm)		
30cm	725.29	640.17
45cm	555.05	
CD at 5%	3.53	
Fertilizer(N+P₂O₅)		
0+0	630.06	640.17
0+20	641.37	
10+20	645.47	
20+40	643.79	
CD at 5%	NS	

with 45 cm row spacing, the increase was 13.8%, 6.4% and 1.4% respectively.

Farmers' fields

In farmers' fields, 'Cridalatha' yielded 34.1% higher grain with a range of 30.7 to 38.4% over the local varieties.

'Cridalatha' as an inter/sole crop in drought prone areas of arid and semi-arid agro-ecological zones which could provide the much needed alternative crop with nutritional security for the farmers including the small and marginal as well as for animals. The biomass of the crop is not only nutritious as recommended by Krishna Murthy and Rama Prasad (2005) but also horsegram hay at 70% level was considered superior over other crops for sheep in a crop rotation. Animal farmers in India swear that horsegram is one of the most nourishing foods especially for bullocks (Ghotge 2006).

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