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Research Article

A new high yielding Spanish bunch groundnut variety CO 7 (ICGV 00351) for the drought prone areas of Tamil Nadu

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Abstract
A high yielding Spanish bunch groundnut culture ICGV 00351 (a cross derivative of ICGV 87290 X ICGV 87846) developed at ICRISAT (International Crops Research Institute for the Semi-Arid Tropics), Patancheru, Andhra Pradesh was evaluated along with six other promising varieties in drought prone areas of Tamil Nadu under Farmers' Participatory Varietal Selection Trials. Culture ICGV 00351 recorded an overall mean dry pod yield of 2189 kg/ha under rainfed situation. This culture with duration of 105 to 110 days registered a pod yield increase of 17 and 26 per cent over the popular varieties of this region viz., VRI (Gn) 6 and TMV (Gn) 13 respectively. It has 71% shelling and 51 % oil and 22% protein content. This culture has also showed tolerance reaction to major foliar diseases *viz.*, late leaf spot and rust. As this variety has improved pod yield along with consumer and trader preference, this culture ICGV 00351 has been released as CO 7 for cultivation in the entire state of Tamil Nadu.

Keywords: Groundnut, farmers participatory varietal selection, pod yield.

Introduction

Groundnut (*Arachis hypogaea* L.) is the major oilseed as well as food legume crop in India accounting for 20% of oilseed area and 23% of oilseed production in the country. India is the second largest producer of groundnut in the world with annual production of over 5.5 million tons. Gujarat, Tamil Nadu, Andhra Pradesh, Rajasthan and Karnataka are the leading producers in the country and accounts for nearly 85% of the total output. Tamil Nadu is one of the leading groundnut producing state with an area, production and yield of 3.85 lakh hectares, 10.61 lakh tons and 2751 kg/hectare respectively. Groundnut is grown mostly under the rain-dependent situations during *kharif* (June-September) season and it accounts for 70% of total groundnut area in the state. Though the groundnut productivity of the state is still the highest among the different groundnut growing states in the country, the groundnut yield realized over the years showed fluctuations because of frequent changes in the rainfall pattern and also owing to long spell of drought experienced during the crop growth period.

The groundnut plant is drought tolerant and is grown in many areas of the world where most other food legumes fail to produce a crop. However, insufficient water at the time of flowering and fruiting significantly reduces the pod yield in groundnut. Though several agronomic interventions (Wright and Nageswara Rao, 1994) to conserve the soil moisture and enhance the water use efficiency (WUE) (Hebbar *et al.,* 1994) are advocated, identifying groundnut genotypes tolerant to drought offers the best long term and cost effective solution. Apart from this, while breeding the groundnut varieties for higher yield, the breeder is to always keep in mind the preferences of the local farmers and traders on important pod and kernel characteristics to achieve quick adoption and fast spread of newly released varieties. Because many of the newly released varieties have gone unnoticed due to non-preference of these varieties by the local farmers and traders. Hence, Farmers' Participatory Varietal Selection (FPVS), an approach in identifying superior varieties of farmers' preference is an effective strategy in selection of varieties for drought prone areas. Besides complementing on-station research by involving the farmers in selection of varieties, it provides an alternate channel to researchers to allow them to reach farmers with greater acceptance of technological innovations among the farming communities (Nigam, 2009). The present paper reports the evaluation and release of ICGV 00351 as CO 7

through Farmers' Participatory Varietal Selection in Tamil Nadu.

Material and Methods

Seven Spanish bunch groundnut genotypes consisting TVG 0004, VG 0104, R 2001-2, R 2001-3, ICGV 91114 and Chintamani 1 and ICGV were evaluated under FPVS trials along with popular varieties, VRI(Gn) 6 and TMV(Gn) 13 as check varieties. A total of 474 FPVS trials were conducted in Erode and Thiruvannamalai districts consecutively under rainy and post rainy seasons during 2008 and 2009. Trials were laid out in the farmers' field in unreplicated form with a plot size of $50m^2$ for each genotype during kharif season under rainfed conditions at the targeted two districts. Recommended package of practices were adopted in all the locations. Groundnut culture ICGV 00351 was also evaluated for its yield performance along with check varieties VRI (Gn) 6 and TMV (Gn) 13 in the station trials (2007 to 2009), Multi Location Trials conducted in TNAU research stations (2009-10) and Adaptive Research Trials (2010-11). The resistance reaction of the genotypes was assessed by screening against important pests and diseases of groundnut. Oil and protein contents of kernels were analyzed by following standard procedures. The level of their acceptability among the farmers on their overall field performance and traders for their market preference was assessed by score card which was prepared by us. This was used to score all the seven genotypes along with the check varieties on 1 to 10 scale; 1 is for least and 10 for most preferred.

Results and Discussion

Among the seven genotypes evaluated for their performance under FPVS in Erode and Thiruvannamalai districts, ICGV 00351 registered the highest mean dry pod yield of 1985 kg/ha followed by ICGV 91114 with 1733 kg/ha in Erode district (Table 1). Similarly, ICGV 00351 recorded the highest dry pod yield of 1506 kg/ha followed by TVG 004 with 1475 kg/ha in Thiruvannamalai district. Combining the results of the 474 trials conducted in two districts, the mean dry pod yield of the genotype ICGV 00351 (1746 kg/ha) was found to be 29.5 per cent higher than the best check variety TMV (Gn) 13 (1348kg/ha). Based on the superiority of the genotype ICGV 00351 for yield, it was promoted for testing under 193 head to head comparison trials along with local checks in the same targeted districts. In spite of poor monsoon and continued drought spell in these districts experienced during the year 2010, the genotype ICGV 00351 was still able to maintain its superior performance by registering dry pod yield of 1931 kg/ha, which is 15.5 per cent higher than the best check variety, VRI (Gn) 6.

After assessing the performance of the genotypes for yield, the level of their acceptability among the farmers on their overall field performance and traders for their market preference was assessed by allowing them to score all the seven genotypes along with the check varieties on 1 to 10 scales. According to the farmers of FPVS trials, culture ICGV 00351 was found to be the most preferred genotype in terms of its overall field performance with a score of 8.9 followed by the genotype ICGV 91114 with a score of 8.5 (Table 2). The genotype ICGV 00351 was also found to be favored by the traders of both the districts by registering the highest score of 8.6 for the market preference followed by two other varieties namely TVG 004 and VG 0104. Hence, genotype ICGV 00351 was found to have a clear edge over others genotypes evaluated for overall acceptability.

Groundnut culture ICGV 00351 is a Spanish bunch variety and a derivative of the cross ICGV 87290 x ICGV 87846. It was developed to withstand moisture stress during critical crop growth period to suit for drought prone subsistence farming. In the rainfed subsistence agriculture, drought is the major cause for low and fluctuating pod yield in groundnut. Genotypic variation in transpiration, water use efficiency (WUE), partitioning of dry matter to pods (P), and rate of recovery from mid-season drought can very well be exploited to develop genotypes with drought tolerance (Nigam and Lenne, 1996). This variety with a unique stay green trait has a remarkable capacity to withstand moisture stress during post flowering, pod development phase. This trait was displayed during evaluation in Erode and Thiruvannamalai districts when the seasonal rainfall was well below the normal. This culture has tan colour testa, medium sized round kernel with an average 42 g as 100 kernel weight, 51% oil content and 22% protein content. The pods are medium sized with a shelling outturn of 71%.

High yielding groundnut genotype ICGV 00351 was field screened for fungal diseases along with the check variety VRI(Gn) 6 and susceptible check TMV 2 (Table 4). Genotype ICGV 00351 was found to be tolerant to late leaf spot and rust diseases. Further, ICGV 00351 was found to be tolerant to thrips, leaf miner and Spodoptera insects under field conditions (Table 5).

This culture with maturity duration of 105 to 110 days was evaluated under Station trials, Multi Location Trials and also under Adaptive Research Trials along with the check varieties VRI(Gn) 6 and TMV(Gn) 13 to assess its performance and also its suitability for cultivation in different groundnut growing districts of Tamil Nadu. In these trials also the culture maintained its impressive performance by registering 20 %, 10 % and 11 % higher pod yield than the best check

variety, respectively (Table 6). The culture ICGV 00351 recorded with a mean dry pod yield of 2189 kg/ha which is 17 % and 26% higher than popular check varieties VRI(Gn) 6 and TMV(Gn) 13, respectively. Hence, this culture with much improved yield and consumer preference has been released as CO 7 and recommended for cultivation in all groundnut growing zones of Tamil Nadu.

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Table 1. Performance of groundnut genotypes under Farmers' Participatory Varietal Selection Trials conducted in Erode and Thiruvannamalai districts for dry pod yield (kg/ha)

Genotype	Erode			Thiruvannamalai		
	Kharif, 2008	Kharif, 2009	Mean	Kharif, 2008	Kharif, 2009	Mean
TVG 004	2304	1026	1665	1347	1475	1411
VG 0104	2286	1017	1652	1275	1366	1321
R 2001-2	1874	954	1414	1065	1245	1155
R 2001-3	1763	885	1324	1185	1378	1282
ICGV 00351	2684	1285	1985	1429	1583	1506
ICGV 91114	2421	1045	1733	1284	1471	1378
Chinthamani	2115	794	1455	1072	1215	1144
VRI (Gn) 6 ©	2192	1021	1607	881	1284	1083
TMV (Gn) 13 ©	2234	868	1551	996	1293	1145
Mean	2208	988	1598	1170	1368	1269
Number of trials	107	87		99	181	

Table 2. Scoring of groundnut genotypes by the farmers and traders of Erode and Thiruvannamalai districts

Genotype	Famers' score on field performance*			Traders' score on pod and kernel traits**		
	Erode	T.Malai	Mean	Erode	T.Malai	Mean
TVG 004	8.0	7.6	7.8	7.1	8.1	7.6
VG 0104	7.5	7.4	7.5	7.3	7.8	7.6
R 2001-2	5.4	6.5	6.0	6.3	6.7	6.5
R 2001-3	5.8	7.1	6.5	6.1	6.4	6.3
ICGV 00351	8.9	8.8	8.9	8.7	8.5	8.6
ICGV 91114	8.6	8.4	8.5	7.5	6.6	7.1
Chinthamani	7.1	6.4	6.8	6.7	7.3	7.0
VRI (Gn) 6 ©	6.8	5.4	6.1	4.9	5.2	5.1
TMV (Gn) 13 ©	6.2	6.3	6.3	5.4	7.5	6.5
Mean	7.1	7.1	7.2	6.7	7.1	6.9
Number of farmers/traders	194	280		25	32	

T.Malai = Thiruvannamalai

*Farmers' scoring of genotypes based on overall acceptability of the genotypes for yield, drought tolerance, reaction to pests and diseases, pod and kernel appearance and size (1 to10 scale, with 1 for least preferred and 10 for most preferred)

**Traders' scoring of genotypes based on overall acceptability of the genotypes for pod size, appearance, shelling percent and kernel appearance, size and testa colour (1 to10 scale, with 1 for least preferred and 10 for the most preferred)

Table 3. Pod and kernel characters of groundnut culture ICGV 00351

Characters	ICGV 00351	VRI Gn 6 (c)	TMV Gn 13(c)
100 pod weight (g)	112	90	82
Shelling (%)	71	69	67
100-kernel weight (g)	42	35	34
Sound mature kernel (SMK) (%)	83	81	82
Oil content (%)	51.0	49.5	50.0
Protein content (%)	22.0	22.5	21.5

Table4. Reaction of groundnut culture ICGV 00351 to foliar fungal diseases

Disease	ICGV 00351	VRI (Gn) 6 ©	TMV 2 ©
Late leaf spot (1-9 score)	3.5	4.0	7.0
Rust (1-9 score)	4.5	5.0	8.0

(Visual scoring based on a scale of1-9. 1 = 0% Disease severity; 2 = 1-5% Disease severity; 3 = 6-10% Disease severity; 4 = 11-20% Disease severity; 5 = 21-30% Disease severity; 6 = 31-40% Disease severity; 7 = 41-60% Disease severity; 8 = 61-80% Disease severity; 9 = 81-100% Disease severity (Subrahmanyam, 1995)

Table 5. Reaction of groundnut culture ICGV 00351 to insect pests

Pest	ICGV 00351	VRI (Gn) 6 ©	VRI 2 ©
Thrips (% damage)	10.4	15.7	22.8
Leaf miner (% damage)	7.5	16.5	32.1
Spodoptera (% damage)	9.7	10.5	13.5

(Visual scoring based on foliar damage on percentage(0% = Immune; 1 - 20% = Resistant/Tolerant; 21 – 40%= Moderately Resistant; 41 – 60%= Moderately Susceptible; 61-100%= Highly Susceptible)

Table 6:Overall performance of groundnut culture ICGV 00351 in various trials for dry pod yield (Kg/ha) during kharif season under rainfed conditions for mean dry pod yield (kg/ha)

Name of the trial	No. of locations	ICGV 00351	VRI (Gn) 6 (C)	TMV (Gn) 13 (C)	Per cent increase over best check (%)
FPVS Trials (2008&2009)	474	1746	1345	1348	29.5
FPVS Head to Head Comparison (2010)	193	2231	1931	1723	15.5
Station trials (2007,08,09)	3	2158	1802	1631	19.8
Multi Location Trials (2009)	6	2453	2240	1833	9.5
ART (2010&2011)	66	2358	2066	2129	10.8
Mean of 742 locations	-	2189	1877	1733	16.6