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Development of Medium Duration, High Oil Content and Yield Potential Groundnut Variety Konkan Bhuratna for Konkan Region of Maharashtra State, India

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A B S T R A C T

The groundnut variety, Konkan Bhurtana (RTNG 29) was evolved from the cross between PBS 24030 and GPBD 4 using former parent through hybridization followed by pedigree method of selection. Konkan Bhuratna variety is medium duration (115-120 days), Virginia Bunch type groundnut culture having 2.5 to 3.0 t/ha average pod yield, with 50.01 % oil content, 23.44% protein content and 74 % shelling percentage, it is medium bold kernel type variety, suitable for both kharif and rabi season. It is resistant to early and late leaf spot, rust, PBND, alterneria leaf blight diseases and also resistant to thrips, jassids, leaf miner, defoliator insect and pests. Therefore the groundnut variety Konkan Bhuratna recommended for release for commercial cultivation in upland area during Kharif and irrigated area during Rabi season in Konkan region of the Maharashtra state during the year 2017.

Introduction

Groundnut is considered to be the one of the most important oilseed crops in the world. It is cultivated in more than 100 countries on 26.54 m hectare area with an annual production of 43.91 m tonnes and productivity of 1655 kg/ha (FAOSTAT, 2015). In India, groundnut is grown on 4.77 m hectare area with the production of 7.40 m tonnes (FAOSTAT, 2015). The productivity of groundnut in India is low (1552 kg/ha) compared to Israel (7389 kg/ha), USA (4397 kg/ha), China (3492 kg/ha) and Argentina (2848 kg/ha) (FAOSTAT, 2015). Groundnut kernels are regarded as healthy foods as their nutrient profile is balanced (Arya *et al.*, 2016). The kernels contain 48-50% oil, 10-20% carbohydrates, and 25-28% easily digestible protein, and provide 564 kcal of energy for every 100 g of kernels (Arya *et al.*, 2016)

In Maharashtra state it is cultivated on area of 1.96 lakh hectares with productivity of 1163 kg/ha during *kharif* season and 0.71 lakh ha area with 1366 kg/ha productivity during *rabi* season 2014-15. In *Konkan* region groundnut is grown on about 20,000 ha area with 1.8 t/ha productivity. The groundnut crop is new in

this region. However, the area under *konkan* is increased enormously. The upland early duration rice varieties are being replacing with groundnut cultivation due to poor yield in rice. The groundnut is increasing fastly during *rabi* season in commanded areas of different dams and rivers in *konkan* region. The soils are porous, rich in potash, optimum temperature and humidity favors higher pod yields in groundnut which is double as compared to upghat region of rest of Maharashtra.

Therefore, it was essential to devolved, high yielding, medium duration, high shelling percentage with high oil content and having fresh seed dormancy more than 21 days, resistant to major diseases and pests variety for cultivation in groundnut growing tracts of Konkan region of Maharashtra state. With considering the above points the Konkan Bhurtana is developed.

Materials and Methods

It is cross between PBS 24030 and GPBD 4. The selections were made for high oil, fresh seed dormancy, resistance to major disease, pest and high yielding progenies from the segregating generations of above cross. Among the several selections in segregating populations of above cross, a promising pure line during 2010 to 2012 RTNG-29 was selected and further tested in various trials viz., station trials, university trials, state coordinated trials and national co-ordinated trials at various locations in region at state during 2012 to 2016. This culture also tested in agronomical at Agricultural Research Station, Shirgaon, Ratnagiri, MS during *Rabi* 2015-16 and *Kharif* 2016. Total 21 and 20 adoptive trials were conducted during *Rabi* 2015-16 and *Kharif* season 2016 respectively, in five districts of Konkan region of Maharashtra state. The culture was screened for resistance to various insect pests and diseases at endemic sites. The oil quantity and quality parameters were analyzed at Gujarat Laboratory, Gujarat. The pod yield data of various trials were statistically analyzed according to Panse and Sukhatme (1967). Based on pod yield data of various trials, superior kernel yield, resistance for disease and insect pest reactions and stable yield performance at various test locations, Konkan Bhurtan groundnut variety is recommended to release in the state of Maharashtra for commercial cultivation during the year 2017.

Results and Discussion

The characteristic features of Konkan Bhuratna (RTNG-29) recorded as per DUS guideline at the research stations were presented in Table 1. The groundnut variety RTNG-29 is erect in growth habit, leaflet colour dark green, leaf size small (2.6 cm), medium duration (115-120 days), high shelling % (>75 %), Kernel colour tan & Shape cylindrical, Medium bold (100 Kernel wt. 48 g), fresh seed dormancy (26 days) and high oil content (50.01 %).

The yield performance of Konkan Bhuratna groundnut variety in various trials conducted during 2012 to 2016 is presented in Table 2. Konkan Bhuratna (RTNG 29) groundnut variety recorded 35.81 % higher pod yield (4852 kg/ha) over check TKG-Bold (3577 kg/ha) in station trial (*Rabi*) conducted during *Rabi* 2012-13 to 2014-15, similarly, during *kharif* 2013 to 2015 in station it has recorded 4358 kg/ha pod yield which was 58.30 % higher than the check TKG-Bold (Anonymous, 2017).

In university multilocation trials conducted on university farm at 7 different location Konkan Bhuratna has been recorded 19.81% (3731 kg/ha) higher pod yield over the check TKG-bold (3114 kg/ha) in two season both in *Kharif* and *Rabi*.

Table.1 Characteristic of groundnut culture, RTNG-29 as per DUS guidelines

S. No	Characteristics	RTNG-29	S. No	Characteristics	RTNG-29
1. (*) (+)	Plant: Growth habit	Erect	11. (*)	Pod: Number of kernels (on 100 pod basis)	>60% 2 seeded
	Erect			>60% 2 seeded	
	Semi- spreading			>60% 3 seeded	
	Spreading			>60% 4 seeded	
2. (*)	Leaflet: Size(fully developed basal leaflet)	Small (2.6 cm)	12. (*) (+)	Pod: Presence of beak	Present
	Small (<4.0 cm)			Absent	
	Medium (<4.0 –6.0cm)			Present	
	Large (>6.0 cm)				
3.	Leaflet: Colour	Dark green	13.	Pod: Shelling percentage	Medium (>75 %)
	Light green			Low (<66)	
	Green			Medium (66-75)	
	Dark green			High (>75)	
4. (+)	Stem: Pubescence	Medium	14. (*)	Testa: Colour	Uniform
	Absent			Uniform	
	Sparse			Variegated	
	Medium		15 (*).	Kernel: Colour of testa (varieties with monochrome testa only)	Tan (12 E 4)
5. (*) (+)	Flower: Presence on main axis	Absent		White (1 A 1)	
	Absent			Off white(1 A 2)	
	Present			Tan (12 E 4)	
6. (*) (+)	Flower: Arrangement on side branches	Irregular		Rose (Grayish red 8 B 3)	
	Sequential			Purple (14 F 4)	
	Alternate			Dark purple (14 F 7)	
	Irregular			Salmon (6 A 4)	
7. (+)	Inflorescence	Simple		Red (10 B 7)	
	Simple			Dark red (11 C 8)	
	Compound		16. (+) (*)	Kernel: Shape	Cylindrical
				Spheroid	
8. (*)	Time of maturity(For curing)			Cylindrical	
	Very early (< 90 days)			Fusiform	
	Early (90-100 days)	Medium (115-120 days)	17. (*)	Kernel: Weight of 100 kernels (about 9% moisture)	Medium (45 to 50g)
	Medium (101-120 days)			Low (<36 g)	
	Very late (>120 days)			Medium (36-50 g)	
				High (51-65 g)	
9. (*) (+)	Pod: Constriction	Medium (5)		Very high (>65 g)	
	Absent		18. (*)	Seed: Fresh seed dormancy	Present (26 days)
	Shallow			Absent	
	Medium			Present	
	Deep		19.	Kernel: Oil percentage	High (50.01 %)
10. (*) (+)	Pod: Reticulation	Medium		Low (<45%)	
	Absent			Medium (45-48%)	
	Medium			High (49-52%)	
	Prominent			Very high (>52%)	

Table.2 Yield performance of Konkan Bhuratna in different trials conducted at different locations during 2012-13 to 2015-16

Sr. No.	Trials	Year/Season/Location	Average pod yield (Kg/ha)		% Increase over Check
			Konkan Bhuratna	Check	
1.	Station Trial (Rabi)	2012-13 to 2014-15 (3 seasons)	4858	3577	35.81
2.	Station Trial (Kharif)	2013 to 2015 (3 seasons)	4358	2753	58.30
3.	University Trial (Rabi)	2012-13 to 2013-14 (2 seasons & 7 locations)	3731	3114	19.81
4.	University Trial (Kharif)	2013 to 2014 (2 seasons & 7 locations)	3281	2458	33.48
5	State SMVT (Kharif)	2013 to 2016 (4 seasons & 6 locations)	2855	2013	41.83
6.	AICRP-G Trial (Kharif)	2016 (1 Season & 9 locations)	2349	1804	30.24
7.	Adaptive Trial (Rabi)	2015-16 (5 districts & 21 locations)	2662	2216	20.13
8.	Adaptive Trial (Kharif)	2015-16 (5 districts & 20 locations)	3108	2039	52.43
9.	Agronomical Trial (Rabi)	2015-16	4850	3472	39.69
10.	Agronomical Trial (Kharif)	2016	4634	3393	36.58
	Average		**3669**	**2684**	**36.69**

Table.3 Yield performance of Konkan Bhuratna (RTNG-29) in State Multilocation Varietal Trials (SMVT) at different locations during 2013 to 2016 in Maharashtra state

Year	Locations	RTNG-29	Zonal Ch. AK 159	Local Ch. TKG Bold	% increased over Zonal check	% increased over Local check
2013	6	2935	2240	2039	31.02	43.94
2014	7	2349	1907	2048	23.17	14.70
2015	5	3061	2281	1762	34.20	73.72
2016	7	3075	2347	2203	31.02	39.58
Pooled		**2855**	**2194**	**2013**	**30.14**	**41.83**

Table.4 Yield performance of RTNG-29 in AICRP-G Trials at at various location in Zone Vth during Kharif 2016

S.N.	Entry	Mean	% increased over ICGS 76 (ZC)	% increased over GG 16 (ZC)	% increased over ICGV 00348 (ZC)
1	**Konkan Bhuratna (RTNG 29)**	2349	30.24	45.68	34.64
2	**ICGS 76 (ZC)**	1804			
3	**GG 16 (ZC)**	1613			
4	**ICGV 00348 (ZC)**	1745			

Table.5 Performance of Konkan Bhuratna under adaptive trials conducted on farmer's field during *Rabi* 2015-16 and *Kharif* 2016

Year	No. of Trials	No. of District	RTNG-29	Check TKG-Bold	% Increase over check
Rabi 2015-16	21	05	2662	2216	**20.13**
Kharif 2016	20	05	3108	2039	**52.43**

Table.6 Pod yield of groundnut as influenced by genotypes/varieties, spacing and different fertilizer levels *Rabi* 2015-16

Genotypes	Spacing	Fertilizer levels			
		F_0 (00:00:00 kg NPK/ha)	F_1 (25:50:00 kg NPK/ha)	F_2 (30:70:00 kg NPK/ha)	Mean
V_1 (RTNG-29)	S_1 (30 x 10 cm)	23.07	39.79	**48.50**	37.12
	S_2 (30 x 15 cm)	22.41	33.58	37.93	31.30
	S_3 (45 x 10 cm)	23.58	30.04	33.64	29.09
V_2 (TKG-Bold)	S_1 (30 x 10 cm)	20.49	29.33	**34.72**	28.18
	S_2 (30 x 15 cm)	19.41	22.17	30.94	24.17
	S_3 (45 x 10 cm)	17.46	25.74	31.61	24.93
	Mean	**21.07**	**30.11**	**36.22**	**29.13**

Table.7 Pod yield of groundnut as influenced by genotypes/varieties, spacing and different fertilizer levels *Kharif*- 2016

Genotypes	Spacing	Fertilizer levels			
		F_0 (00:00:00 kg NPK/ha)	F_1 (25:50:00 kg NPK/ha)	F_2 (30:70:00 kg NPK/ha)	Mean
V_1 (RTNG-29)	S_1 (30 x 10 cm)	25.48	37.96	**46.34**	36.59
	S_2 (30 x 15 cm)	22.68	27.14	31.54	27.12
	S_3 (45 x 10 cm)	23.77	26.50	29.82	26.70
V_2 (TKG-Bold)	S_1 (30 x 10 cm)	23.13	29.68	**33.93**	28.91
	S_2 (30 x 15 cm)	21.09	23.75	29.06	24.63
	S_3 (45 x 10 cm)	21.49	22.89	26.72	23.70
	Mean	**22.94**	**27.99**	**32.90**	**27.94**

Table.8 Quality analysis of Konkan Bhuratna (RTNG-29) culture (Test Report of Gujarat Laboratory)

Name of the culture / check	Test Parameters							
	Oil (%)	Protein (%)	Palmitic Acid (%)	Steric Acid(%)	Oleic Acid (%)	Linoleic Acid (%)	Arachidic Acid (%)	Bahenic Acid (%)
RTNG-29	50.01	22.44	14.60	3.20	46.08	31.71	0.78	2.28
TKG-Bold	48.11	24.56	13.09	2.82	45.81	33.16	1.12	2.76
Konkan Gaurav	47.12	24.05	13.96	3.23	49.28	29.25	0.83	2.18

Table.9 Reaction to major diseases on the basis of pooled mean (Rb-2012-13 to Rb-2014-15)

Entry	ELS (0-9) Scale		LLS (0-9) Scale		Rust (0-9) Scale		PBND (%)		Alterneria leaf blight (0-9) Scale	
Date of appearance	20-25 Days		55-60 Days		62-65 Days		40-45 Days		45-60 Days	
RTNG-29	0.0	HR	1.0	R	1.3	MR	1.5	R	1.7	R
TKG Bold (Ch-I)	0.0	HR	3.2	MS	1.6	MR	2.8	MR	2.9	MR
Konkan Gaurav (Ch-II)	0.0	HR	2.6	MS	2.8	MS	2.6	MR	2.7	MR

Table.10 Reaction to major diseases on the basis of pooled mean (Kh-2013 to Kh-2015)

Entry	ELS (0-9) Scale		LLS (0-9) Scale		Rust (0-9) Scale		PBND (%)		Alterneria leaf blight (0-9) Scale	
Date of appearance	20-25 Days		55-60 Days		62-65 Days		40-45 Days		45-60 Days	
RTNG-29	0.0	HR	1.0	R	1.2	MR	1.6	R	1.4	R
TKG Bold (Ch-I)	0.0	HR	2.3	MR	2.0	MR	2.7	MR	2.2	MR
Konkan Gaurav (Ch-II)	0.0	HR	3.0	MS	3.2	MS	2.7	MR	2.4	MR

Table.11 Reaction to major Insect pests on the basis of pooled mean (Rb-2012-13 to Rb-2014-15)

Entry	Thrips			Jassids			Leaf miner		Defoliator	
	30D	**60D**	**90D**	**30D**	**60D**	**90D**	**30D**	**60D**	**90D**	**30D**
RTNG-29	1.6	1.9	0.9	1.1	1.0	0.9	1.1	1.6	1.0	1.5
Reaction	HR	HR	HR	HR	HR	HR	HR	HR	HR	HR
TKG-Bold (Ch-I)	4.6	5.2	4.6	2.8	2.2	1.5	4.4	5.4	4.9	6.6
Reaction	MS	S	MS	R	R	HR	MR	MS	MS	S
Konkan Gaurav (Ch-II)	3.0	3.2	3.8	2.2	1.9	1.7	3.2	4.5	4.0	3.2
Reaction	MR	MR	MR	R	HR	HR	MR	MR	MS	MR

Table.12 Reaction to major Insect pests on the basis of pooled mean (Kh-2013 to Kh-2015)

Entry	Thrips			Jassids			Leaf miner		Defoliator	
	30D	**60D**	**90D**	**30D**	**60D**	**90D**	**30D**	**60D**	**90D**	**30D**
RTNG-29	2.2	1.8	1.2	1.6	1.9	1.1	1.0	1.6	1.8	1.7
Reaction	R	HR	R	HR	HR	HR	HR	HR	HR	HR
TKG-Bold (Ch-I)	5.3	4.7	4.4	3.3	2.6	2.2	3.2	4.7	4.7	5.1
Reaction	S	MS	MS	R	R	R	MR	MR	MS	S
Konkan Gaurav (Ch-II)	3.5	3.3	3.6	2.6	2.0	2.6	3.6	3.3	3.7	3.3
Reaction	MR	MR	MR	R	R	R	MR	MR	MR	MR

In state multilocation varietal trials conducted during *Kharif* 2013, *Kharif* 2014, *Kharif* 2015 and *Kharif* 2016 in these 4 seasons, and six different locations, Konkan Bhuratna (RTNG-29) has recorded 31.02%, 23.17%, 34.20 % and 31.02% increased pod yield over zonal check AK-159 respectively, while as it was recorded 43.94%, 14.70%, 73.72% and 39.58% higher pod yield over local check TKG-Bold, respectively. On the basis of pooled mean performance of state multilocation trial, it showed 30.14% and 41.83% increased pod yield over zonal and local check respectively, Table 3 (RRC Report 2014, RRC Report 2015 and RRC Report 2016).

Konkan Bhurtna was evaluated in All India Coordinated Trials testing code at nine different locations during Kharif- 2016 in the country. It showed 30.24 %, 45.68 % and 34.64 % increase in pod yield over Zonal Checks, ICGS 76, GG 16 and ICGV 00348 respectively conducted during *Kharif*-2016 season indicating it's wider adaptability in varied agro-ecological situations in the country (Table 4) (DGR Report, 2017).

The groundnut culture, Konkan Bhuratna (2662 and 3108 kg/ha) has recorded 20.13% and 52.43% increase in pod yield over check TKG-Bold (2216 and 2039 kg/ha) in 21 and 20 adaptive trials conducted in five district during *Rabi* 2015-16 and *Kharif* 2016 respectively (Table 5).

The Agronomical experiment was conducted at ARS, Shirgaon (Ratnagiri) to study the effect of spacing and different nitrogen levels along on promising groundnut entry, Konkan Bhuratna during *Rabi* 2015-16, recorded higher pod yield 4850 kg/ha by adopting 30 x 10 cm spacing and 30:70:00 NPK kg/ha as fertilizer dose, which was 39.69% higher over cultivar TKG-Bold (3472 kg/ha) by adopting same package of practice (Table 6).

In Agronomical trial, conducted during Rabi season, promising groundnut entry, Konkan Bhuratna given higher pod yield 4634 kg/ha by adopting 30 x 10 cm spacing and 30:70:00 NPK kg/ha as fertilizer dose, which was 36.58% higher over cultivar TKG-Bold (3393 kg/ha) by adopting same package of practice (Table 7).

The oil quantity and other quality analysis of Konkan Bhuratna groundnut variety was estimated at the Gujrat Laboratory during the year-2016.

It showed high oil content (50.01 %), protein content (23.44 %), Palmitic Acid (14.60 %), Steric Acid (3.20%), Oleic Acid (46.08%), Linoleic Acid (31.71%), Arachidic Acid (0.78 %) Bahenic Acid (2.28 %) (Table 8).

Konkan Bhuratna is resistant to early and late leaf spot, rust, PBND, alterneria leaf blight diseases and also resistant to thrips, jassids, leaf miner, defoliator insect and pests (Table 9-12).

Konkan Bhurtana, groundnut variety is dwarf in height (25-30 cm), medium in duration (115-120 days), having good shelling percentage (*kharif* 73.5-76.0% and *rabi* 70.2-76.3%), medium bold type (100 kernel weight (45-50 g), having fresh seed dormancy (26 days), high oil content (*kharif* 50.02-50.08% and *rabi* 49.70-50.14%), resistant to thrips, jassids, leaf miner and defoliator insect pests and resistant to early, late leaf spot, rust, PBND and alterneria leaf blight diseases. It is suitable for groundnut growing areas of Maharashtra.

Therefore the groundnut variety Konkan Bhuratna recommended for release as a commercially cultivation in upland area during *kharif* and irrigated area during *rabi* season in Konkan region of the Maharashtra state in the year 2017.

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