IMPROVED CULTIVARS AND MOISTURE CONSERVATION PRACTICES FOR RAINFED GROUNDNUT

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FOREWORD

Groundnut is the most important oilseed crop contributing about 40% production of the total oilseeds in the country. The research programmes undertaken by the All India Coordinated Research Project on Groundnut have resulted in perceptible enhancement in the productivity levels of groundnut in different agro-ecological situations through development of high yielding cultivars and economically viable production and protection technologies. However, while its area remained stagnated around 8 million ha, the production fluctuates vigourously over the years. The major reason for such low and unstable production is the cultivation of groundnut predominantly in rainfed areas under sub optimal conditions of moisture and other inputs. There is an urgent need for a critical analysis of specific constraints, refinement of available technologies and development of relevant and acceptable integrated technologies for better adoption by resource poor farmers. Among the production factors, moisture and nutriment management have been identified as the most critical in enhancing the productivity of rainfed groundnut. In the present project, groundnut cultivars have been evaluated for moisture and nutrient stress under rainfed situations.

The results of large-scale on-farm trials carried out in the project convincingly showed that integrating recommended moisture conservation and fertilizer application with appropriate cultivars can bring about significant gains in groundnut production and sustainable income to farmers of the region. I complement the efforts of the authors for bringing out this bulletin reflecting the salient achievements of the project for the benefit of the important groundnut growing regions of the country.

Junagadh
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Improved cultivars and moisture conservation practices for rainfed groundnut

1. Introduction:

Groundnut is an important food legume of the world. It is grown in about 26.5 m ha spread over 85 countries. The world's production of groundnut is about 35.8 m tonnes with an average productivity of 1347 kg/ha (FAOSTAT, 2003). India is a leading groundnut producing country, second to China, since it accounts for about 34.5 % of world's area and about 27.3 % of production of groundnut. However, India ranks 10th in productivity in the world. The low yield level of groundnut is mainly due to the facts that most of the groundnut in our country is grown in rainfed areas and in marginal lands with low inputs.

In India groundnut is grown in three seasons; kharif (about 84% area), rabi (about 11% area) and summer (about 5% area). About 88% of area and production of kharif groundnut are confined to five states, namely, Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra. However, the productivity of kharif groundnut is the lowest (1041 kg/ha) among the three seasons. Irregular monsoon causing in moisture deficit during the crop growth period is the main reason behind low and uncertain productivity of kharif groundnut

An overview of groundnut crop in Saurashtra region of Gujarat

Among different components of recommended package of practices, improved variety contributes up to 30% to the over all yield improvement. Application of balanced fertilizers improves fertilizer use efficiency and, pod yield of groundnut. Availability of soil moisture during critical growth period is the key factor affecting the sustainability of groundnut productivity of rainfed groundnut

To improve the productivity of rainfed oilseed crops, a project entitled "Evaluation of cultivars of major oilseed crops of the production system for moisture and nutrient constraints in different soil types" was undertaken under the funding of NATP. Groundnut was evaluated at Junagadh (Vertisols soil), Gujarat, and Kadiri (Alfisols soil), Andhra Pradesh.

2. Extent of the problem

In rainfed farming, maintenance of optimum soil moisture especially at critical crop growth stages is the key factor for realizing higher productivity. Groundnut, predominantly grown as rainfed crop in the country, suffers from severe moisture stress at one or several stages of its growth because of inadequate and uneven distribution of rainfall during the season. Also, the area of groundnut under irrigation is only about 18% in the country. Looking into the competition for irrigation water from more important crops like cereals and commercial crops, possibility of increasing area under irrigation in groundnut seems to be very meager. Thus, improvement in yield of rainfed groundnut has to come from better management of soil moisture along with balanced nutrition and adoption of responsive cultivar.

3. Approach

Limited work has been carried out for conserving in-situ moisture in rainfed groundnut. However, the rate of adoption of these technologies by the farmers remains notably low and is still insufficient to have a real impact on rainfed cultivation. Evaluating these moisture conservation techniques in an isolation

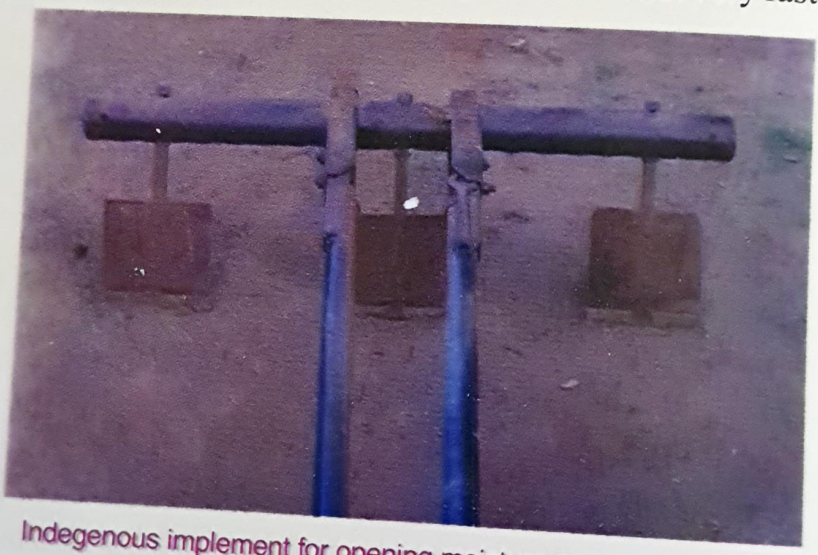
without taking into consideration of cultivar and nutrient supply in the soil perhaps was the main reason behind such a low impact of these technologies on the real farming situations. This suggests the need for taking more comprehensive approach while developing in-situ moisture conservation techniques for rainfed framing. Hence, a field experiment on moisture conservation techniques along with fertilizer and cultivar was conducted on the farmers field under real farming situations in Saurashtra region of Gujarat and Rayalseema region of Andhra Pradesh, the two most important groundnut growing regions of the country.

Improved moisture conservation practice in Spanish Groundnut

4. Socio-economic profile of participating farmers

The farmers of Saurashtra region of Gujarat are small to marginal with an average land holding of less than one hectare. Most of the farmers have bullock as a drought power. However, about 10% of the farmers also have tractor for cultivation. About 70% of the farmers have milch animal, and adopt milk production as secondary enterprise. Education level of the farmers is fairly good; hence they are highly motivated to adopt new improved crop production technology. However, the area is drought prone and only mono cropping of groundnut is practiced due to very little irrigation facility.

The farmers of the Rayalseema region of Andhra Pradesh are resource poor, marginal with an average land holding of less than one hectare. The drought power is bullock. They adopt animal husbandry as side enterprise. Poultry and goat rearing are also adopted by some of the farmers. Education level of the farmers is poor. Most of agricultural operations are performed by bullock power or by manual. Since most of the farmers are resource poor, risk-bearing capacity in agriculture is very poor, hence adoption of new/improved technologies in agriculture is not very fast.



Indegenous implement for opening moisture conservation furrow

5. Methodology

5.1. Junagadh (Vertisols)

A total number of 64 on-farm trials were conducted from 2000 to 2002 in 7 villages of Junagadh district, Gujarat. In 2000, twenty-four on-farm trials were conducted in 3 villages with six treatment combinations. The fields were classified into two groups, namely shallow soil (soil depth less than 22.5 cm) and medium soil (soil depth more than 22.5 cm). None of the fields were classified as deep soil. In 2001 and 2002, twenty on-farm trials, in each year, were conducted in shallow and medium soils. The treatment details for each year are given in table 1. In 2003 and 2004, 20 field demonstrations each year on larger plot size (1000 m^2) were

conducted in 6 villages. The distribution of the trials and demonstrations conducted is given in table 2.

Table 1. Details of the treatments of the field experiments conducted in 2000-2004 at Junagadh, Gujarat

Treatment details:

A. Kharif 2000

T1: Local Variety, Farmer's method of moisture conservation, No fertilizer

T2: Local Variety, Recommended moisture conservation, No fertilizer

T3: Local Variety, Recommended moisture conservation, Recommended Fertilizer

T4: Improved Variety, Farmer's method of moisture conservation, No fertilizer

T5: Improved Variety, Recommended moisture conservation, No fertilizer

T6: Improved Variety, Recommended moisture conservation, Recommended fertilizer

Improved method of moisture conservation:
Opening of furrows after every three rows of groundnut

Farmer's practice : Repeated cultivation

Recommended fertilizer : 12.5-25-0 N, P_2O_5, K_2O, kg/ha and gypsum 500 kg/ha

Farmers practice : DAP 50 kg/ha

Variety

	Spanish	Virginia
V1	GG-4	GG-20
V2	GG-2	GAUG 10 (Local)

Plot size: 200 m^2

B. Kharif 2001 & 2002

A: Main plot- Methods of moisture conservation and fertilizer application

M1 - Farmer's method of moisture conservation and fertilizer application

M2 - Farmer's method of moisture conservation and recommended fertilizer application

M3 - Recommended moisture conservation and recommended fertilizer application.

B: Sub plot-Varieties

	Spanish	Virginia
V1	GG-5	GG-13
V2	GG-2	GG-20
V3	J-11 (Local)	GAUG 10 (Local)

C. Demonstrations

T_1= Farmer's method of moisture conservation & fertilizer application with local check (J-11 & GAUG-10)

T_2= Improved moisture conservation & RDF with improved variety (GG-5 & GG-13)

Plot size: 1000 m^2

Improved moisture conservation practice in Virginia Groundnut

Table 2. Distribution of the experiments conducted on farmer's field at Junagadh during kharif 2000 to 2004

Year	No. of villages	Experiments				Total
		Medium depth		Shallow depth		
		Spanish	Virginia	Spanish	Virginia	
2000	3	6	6	6	6	24
2001	2	5	5	5	5	20
2002	2	5	5	5	5	20
Total	**7**	**16**	**16**	**16**	**16**	**64**
Demonstrations						
2003	2	10	10	--	--	20
2004	4	10	10	--	--	20
Total	**6**	**20**	**20**			**40**

5.2. Kadiri (Alfisols)

Thirty-two on-farm trials were conducted in 8 villages of Anantpur district, Andhra Pradesh from 2000 to 2002. In the year 2000, sixteen on-farm trails were conducted in 3 villages. However, 10 and 6 on-farm trials in 3 and 2 villages were conducted in 2001 and 2002, respectively. Field demonstrations on larger plot size (1000 m^2) were laid out in 9 farmer's field of 3 villages in 2003 to 2004. The treatment details and the distribution of trials conducted are given in table 1 and 3, respectively. The details of the cultivar and the moisture conservation practices adopted are given below:

Improved method of moisture conservation:
Working tined harrow at 40 days after sowing

Farmer's practice : No harrowing

Recommended dose of fertilizers : 20-40-50, N, P_2O_5, K_2O, kg/ha

Farmer's method : 9 kg N and 23 kg P_2O_5/ha

Cultivars :
Kharif 2000 and 2002 : K-134, Tirupati 4 and JL-24 (local)
Kharif 2001 : K-134 and JL-24 (local)

Table 3. Distribution of the experiments conducted on farmer's field at Kadiri during kharif 2000 to 2004

Year	No. of Village	Experiments conducted
2000	3	16
2001	3	10
2002	2	6
Total	**8**	**32**
2003	1	3
2004	2	6
Total	**3**	**9**

6. Soil characterization

6.1. Junagadh (Vertisols)

The soils of the region are shallow to medium shallow, moderately to highly calcareous, moderately alkaline, clay loam to clay in texture and grayish brown to dark grayish brown in colour. The soils are low in available OC and nitrogen, medium in phosphorus and medium to high in potash. The availability of important micronutrients like iron and manganese are fairly good, but are marginal in zinc. Due to shallow depth, water-holding

capacity of the soil profile is low. The major constraints of the soil for crop production are depth, gravilliness and high calcium carbonate leading to lime induced deficiency of iron causing in chlorosis of groundnut crop. Bulk density is 1.33 g/cc. The details of soil characterization are given in table 4.

Application of *murram* for improving physical properties of Vertisol

6.2. Kadiri (Alfisols)

The soils of the region are undulated and sloppy with shallow to medium depth, and are red laterite and acidic in reaction.

The organic carbon content is low, thus, the soils are poor in available nitrogen, but medium in available P and K. Due to lateritic nature, water holding capacity is very low. The major constraints of the soil to crop production are low fertility, crust formation and low water holding capacity. The physical and chemical properties of the soils are given in table 4.

Table 4. Physical and chemical properties of the soils of the experimental fields

Sr. No.	Parameters	Junagadh (Vertisols) Medium depth	Junagadh (Vertisols) Shallow depth	Kadiri (Alfisols)
1	pH (1:2.5)	7.83	7.91	6.7-8.9
2	EC (dS/m) (1:2.5)	0.377	0.307	0.056-0.19
3	O C (%)	0.380	0.320	0.23-0.45
4	Available N			
5	Available P (kg/ha)	15.0	14.52	19.49
6	Available K (kg/ha)	208	188	246-560
7	Water content at field capacity (%)	28.8	27.2	17.0
8	Water content at wilting point (%)	14.28	14.15	4.0
9	Bulk density (g/cm^3)	1.33	1.34	1.19

7. Weather conditions

7.1. Junagadh

Saurashtra region of Gujarat comes under semi arid region where low and irregular rainfall is the common characteristic features. Out of five years (2000 to 2004), three years, namely 2000, 2002 and 2004 were semi drought years. In 2000, only 523.5 mm rainfall in 49 rainy days was received. Thus, crop suffered from severe moisture stress especially during its reproductive stage. Similarly, a total rainfall of 540.3 mm in 22 rainy days in 2002 and 650.4 mm in 27 rainy days in 2004 were received. The yield levels were low because of severe moisture stress prevailed during the critical growth stages of the crop. However, the crop received good rainfall in 2001 (826.9 mm in 47 rainy days) and 2003 (1274.5 mm in 42 rainy days) and the yield levels were quite satisfactory. The details of weather parameters are given in Fig. 1.

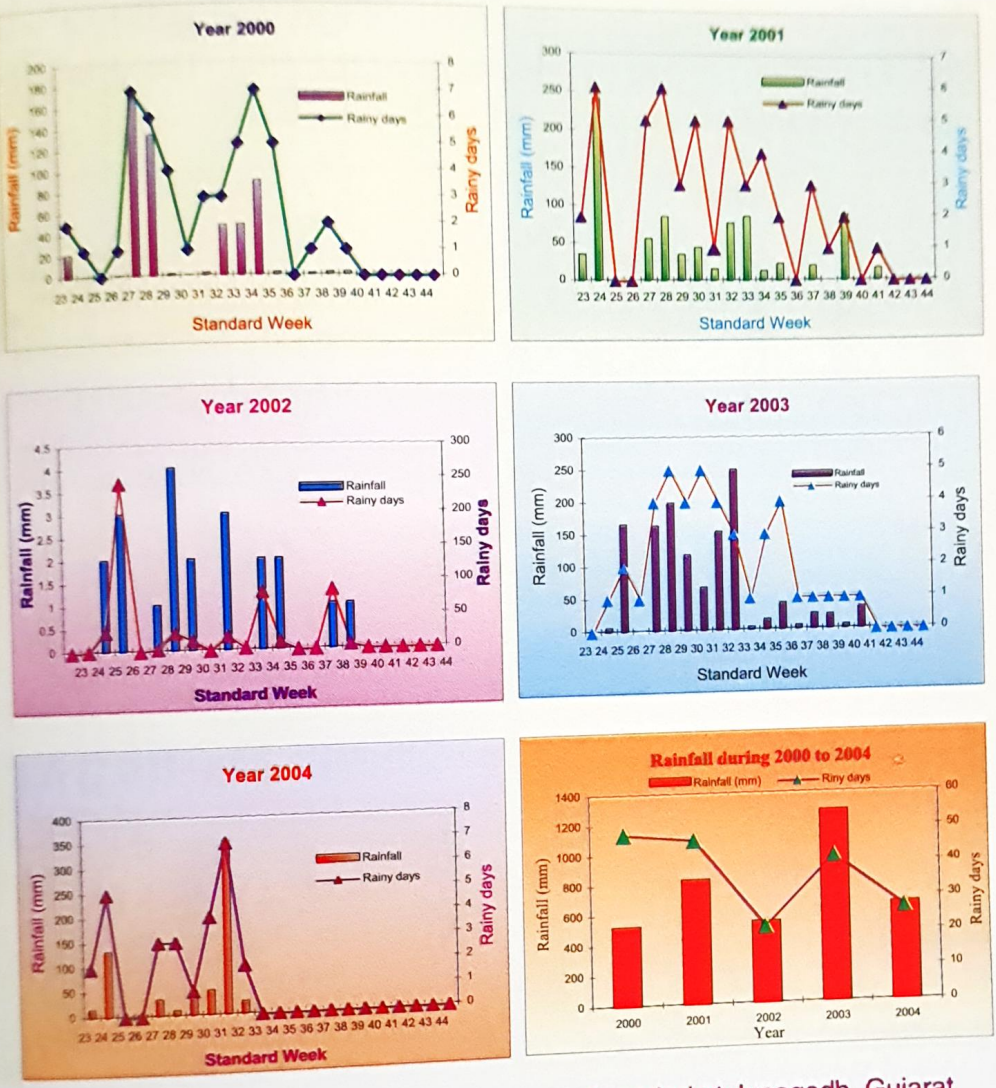


Fig. 1 Rainfall distribution during crop growth period at Junagadh, Gujarat

7.2. Kadiri

The Rayalseema region experienced continuous drought starting from 2000 to 2004. In 2000, 474.8 mm rainfall in 34 rainy days was received. The year 2001 was somewhat better and received 564 mm rainfall in 36 rainy days. In 2002 and 2003, a total of 229.2 mm in 24 rainy days and 368.7 mm in 28 rainy days, respectively, were received. Only 210 mm rainfall in 19 days was received in 2004. Thus, the crop suffered maximum and the yield levels were very poor. In general, onset of monsoon was late and sowing was undertaken in second fortnight of July or first week of

August. Also during its reproductive stage, soil moisture was deficient affecting pod development of the crop. The details of weather parameters are given in Fig. 2.

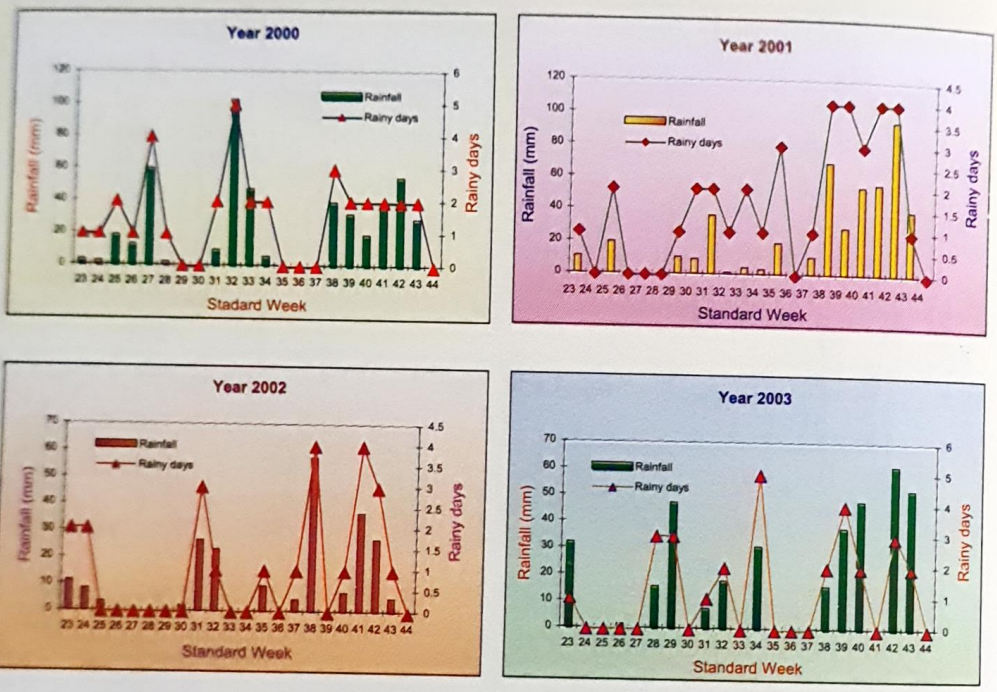


Fig. 2 Rainfall distribution during crop growth period at Kadiri, A. P.

8. Results

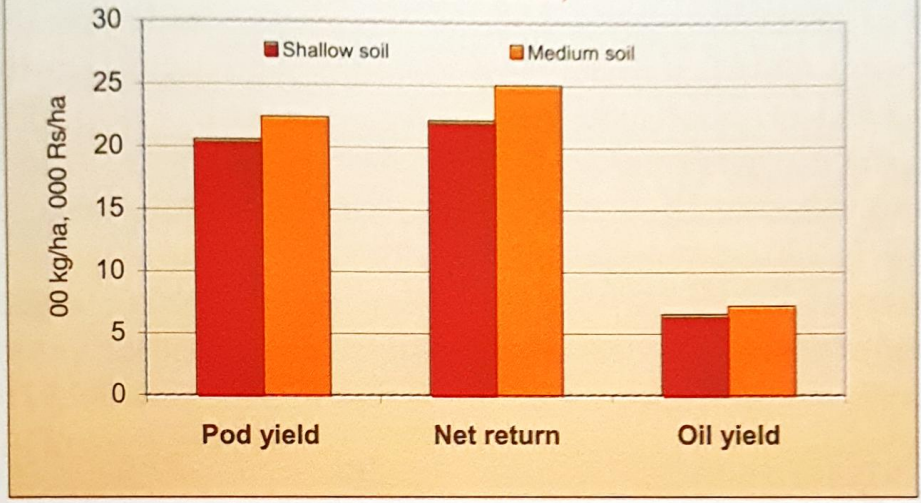
8.1. Junagadh (Vertisols)

8.1.1. Depth of soil

The results of 2000 indicated that crop grown under shallow soil yielded less (976 kg/ha) than that grown under medium soil (1169 kg/ha). Economically also, growing groundnut in medium soil was more profitable (net return Rs. 6183/ha) than growing in shallow soil (Rs. 3213/ha). The pooled results of 2001 and 2002 confirmed the findings of previous year where pod yield was higher by 8.8% under medium soil compared with the shallow soil. Oil yield and net monetary return also increased by 21.1 & 24.4 %, respectively, under medium soil compared with the

shallow soils (Fig. 3). Thus, the results clearly established that raising of groundnut crop should be avoided in shallow soil due to its poor yield.

Fig. 3 Effect of depth of soil on pod yield, oil yield and net return of groundnut at Junagadh (Pooled 2001 & 2002)



8.1.2. Moisture conservation and balanced fertilizer

8.1.2.1. Soil moisture conservation

Rainfall was quite normal and well distributed in the Years 2001 and 2003. Therefore, no difference in soil moisture content due to moisture conservation practice in the soil profile of 0-30 cm was observed. However, in the drought years of 2000 and 2002, significant differences in soil moisture content due to moisture conservation practice were observed and are discussed below.

8.1.2.1.1. Year 2000: The soil moisture recorded from 0-15 and 15-30 cm depth from each treatment during the crop growth period revealed that the treatment having recommended moisture conservation practice maintained slightly higher available soil moisture up to 30 cm depth compared with the farmers practice. Even when there was no rainfall and crop experienced severe moisture stress, improved technology maintained higher soil moisture at 15-30 cm depth of soil up to 37 standard week.

Thereafter, however, no difference in moisture content was observed between two methods of moisture conservation (Fig. 4).

8.1.2.1.2.Year 2002: The soil moisture recorded from 0-15 and 15-30 cm soil depth from each treatment during the crop growth period revealed that the recommended moisture conservation practice maintained slightly higher available soil moisture up to 30 cm depth compared with the farmers practice. At 30 days after sowing (DAS), recommended moisture conservation practice maintained considerable higher soil moisture (14.65 to 15.33 %) than that in the farmer's practice (12.69 to 12.95 %). At 60 and 90 DAS when moderate rainfall was received, improved practice had higher soil moisture of 27.7 to 29.91 % than under the local practice (25.83 to 28.79%). Even when there was no rainfall, and crop experienced severe moisture stress, recommended moisture conservation practice maintained higher soil moisture (19.92%) than that in the local practice (18.32%) at 15-30 cm depth of soil up to 43 standard week (Fig. 4).

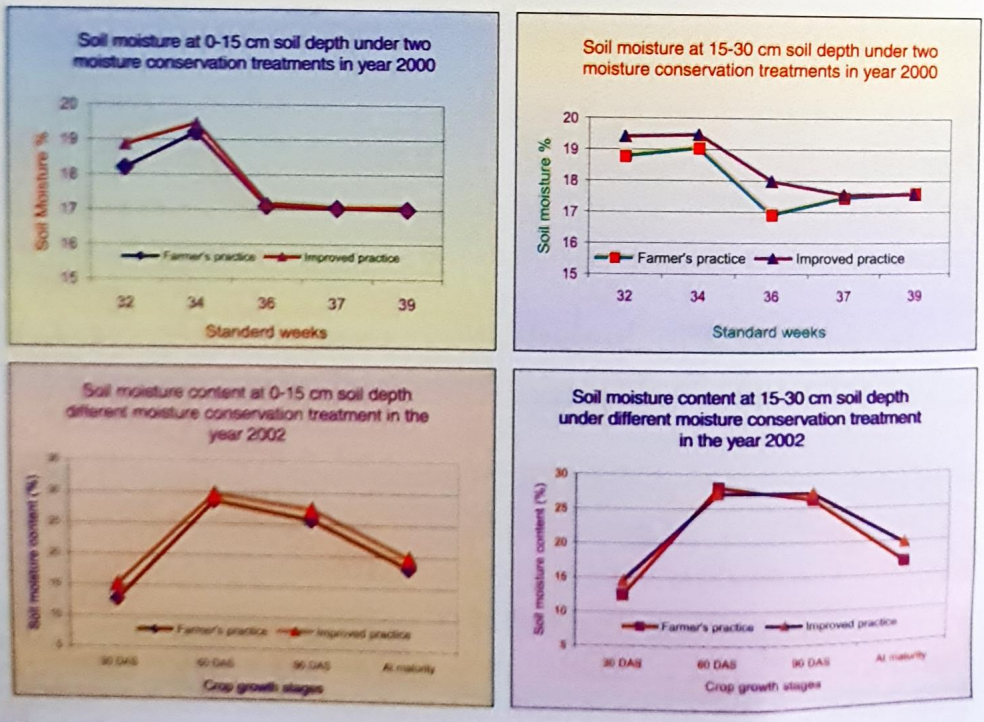


Fig. 4 Soil moisture content at 0-15 and 15-30 cm soil profile in the year 2000 and 2002 at Junagadh

8.1.2.2. Yield

Opening of moisture conservation furrow after every three rows of groundnut and applying recommended fertilizer dose (12.5 kg N, 25 kg P_2O_5 and 500 kg gypsum/ha) were found advantageous and improved the yield significantly over the farmer's practice. In 2000, recommended moisture conservation practice and balanced fertilizer increased pod yield by 16.5% and net return by 7.4% over the farmer's practice (table 5). Pooled results of 2001 and 2002 also revealed that improved method of moisture conservation and balanced fertilizer were advantageous and recorded 9.3 % higher pod yield and 21.1% more oil yield compared with the farmer's practice (Fig. 5).

Table 5: Effect of improved moisture conservation & fertilizer and improved variety on yield and economics of groundnut at Junagadh during 2000

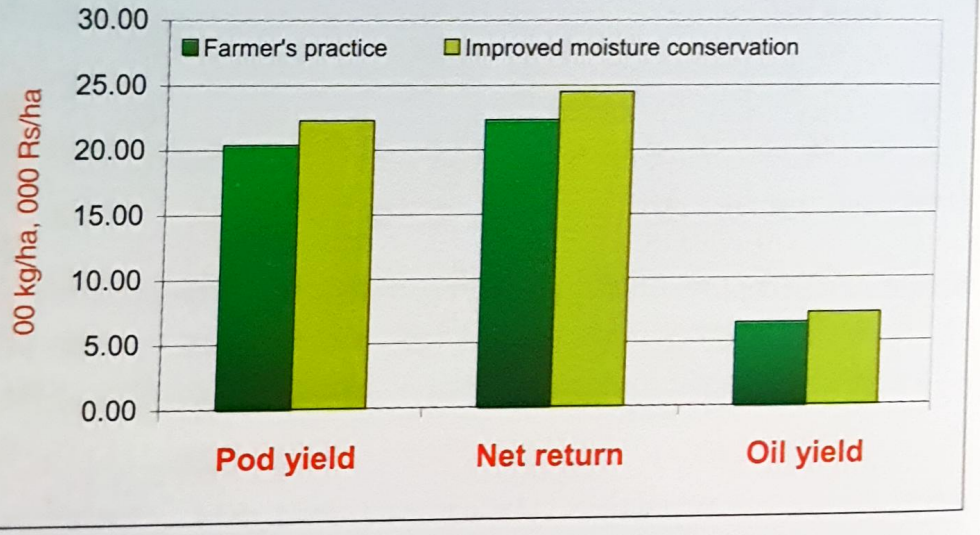
Treatments	Virginia		Spanish	
	Pod yield (kg/ha)	Net return (Rs/ha)	Pod yield (kg/ha)	Net return (Rs/ha)
T1	873	3015	1180	5585
T2	927	3765	1223	5645
T3	945	3800	1233	5555
Mean	**948**	**3525**	**1212**	**5590**
T4	840	3315	1223	6220
T5	929	3575	1262	6220
T6	963	3965	1271	6160
Mean	**927**	**3465**	**1252**	**6220**
S.E. ±	192	--	124	--
C.D. (0.05)	NS	--	NS	--

8.1.2.3. Economics

The net monetary returns were also higher (Rs. 24498/ha) in the improved method of moisture conservations compared to the farmer's practice (Rs. 22327/ha). Even in drought year, improved

method of moisture conservation helped to conserve soil moisture and increased pod yield that resulted in higher monetary returns as compared to the farmer's practice (Fig. 5).

Fig. 5 Effect of Improved moisture conservation on pod yield, oil yied and net return of groundnut at Junagadh (Pooled 2001 & 2002)



8.1.3. Improved cultivars

In the year 2000, the improved cultivar, GG-4, was marginally superior (1252 kg/ha) to local cultivar, GG-2 (1212 kg/ha) and recorded higher net returns of Rs. 6220/ha than Rs. 5590/ha by cultivar GG-2. The pooled results of 2001 and 2002 revealed that improved cultivar, GG-5, performed better than the local cultivar, J-11. The yield increase was 12.8 % due to improved cultivar GG-5 and recorded higher net returns of Rs. 23795/ha than that under local cultivar, J-11 (Rs. 20226/ha) In Virginia cultivars, GG-20 and GG-13 were superior to local cultivar GAUG-10. However, considering the performance of cultivars over the years, GG-13 was superior and recorded 19.4% higher pod yield than that by cultivar GAUG-10. Oil yield and net monetary return were also higher by 27.4 % and 23.1 % respectively than that recorded by local cultivar (table 6).

Table 6. Effect of improved variety of groundnut on yield and economics at Junagadh (2000-2004)

Year	Spanish groundnut					
	Pod yield (kg/ha)		Net return (Rs/ha)		Oil yield (kg/ha)	
	GG-5/ GG-4	J-11/ GG-2	GG-5/ GG-4	J-11/ GG-2	GG-5/ GG-4	J-11/ GG-2
2000	1252	1212	6200	5595	--	--
2001-2002 (pooled)	2192	1944	23795	20226	691	594
2003 (Demo)	2392	1985	27253	22341	1032	860
	Virginia groundnut					
	GG-13	**GAUG-10**	**GG-13**	**GAUG-10**	**GG-13**	**GAUG-10**
2000	910	915	3618	3527	--	--
2001-2002 (pooled)	2443	2046	27485	22336	837	657
2003 (Demo)	2701	2192	27924	22013	1251	1026

Field demonstration showing improved (GG-5) and local (J-11) cultivars

8.1.4. Demonstrations

Forty field demonstrations (20 Spanish and 20 Virginia cultivars) were conducted in kharif seasons of 2003 and 2004 on the farmer's fields to demonstrate the superiority of improved technology to the farmers practice. GG-5 (Spanish) and GG-13 (Virginia) were grown under improved method of moisture conservation. For comparison, local cultivar J-11 (Spanish) and GAUG-10 (Virginia) were grown adopting farmer's method of moisture conservation. The results of 2003 revealed that on an average, improved technology increased pod yield by 20.5 % in Spanish cultivar and by 23.2% in Virginia cultivar over the farmers practice. Total oil yield increased by 20.1 % in Spanish cultivar and by 21.9 % in Virginia cultivar under improved technology compared with the farmers practice. Thus improved technology brought about an additional oil yield of 172-225 kg/ha over the farmer practice (860-1026 kg/ha).

Fig. 6 Effect of improved technology and cultivars on yield and economics of virginia groundnut at Junagadh during 2003

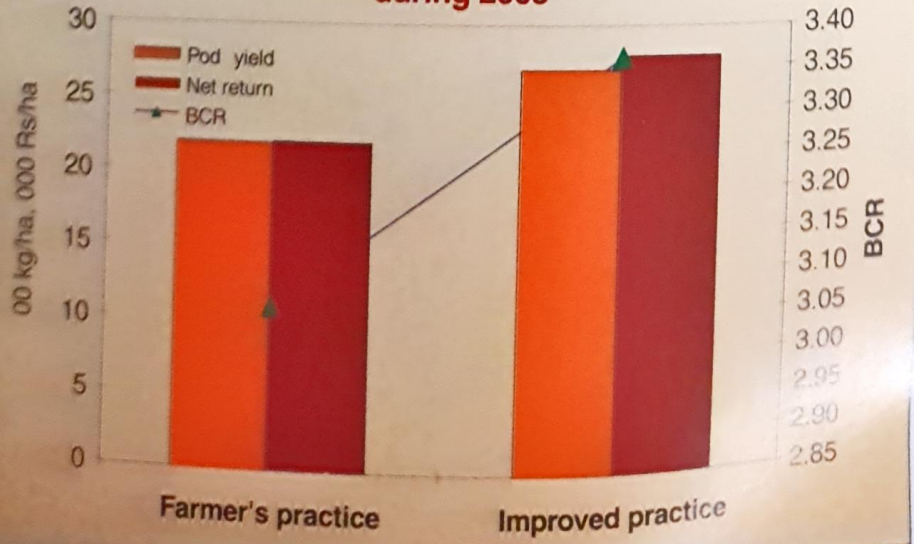


Fig. 7. Effect of improved technology and cultivars on yield and economics of spanish groundnut at Junagadh during 2003

The technology was economically viable as the highest net returns of Rs 27253/ha was realized in Spanish cultivar under improved technology as against the net returns of Rs 22341/ha with the farmers practice. Similarly in Virginia cultivars, the improved technology registered higher net returns of Rs 27924/ha compared with the net returns of Rs 22013/ha under the farmers practice (Fig. 6 and 7). The year 2004 was a drought year where yield levels were low and ranged from 1325-1450 kg/ha in Virginia cultivar and 1307-1525 kg/ha in Spanish cultivar. Adoption of improved technology increased pod yield by 9.4% in Virginia and 16.7% in Spanish cultivars over the farmers practice. The technology also gave higher net returns of Rs. 13540 /ha along with BCR of 2.14 in Virginia and Rs 14707/ha with BCR of 2.24 in Spanish cultivars as against the net returns of Rs 12252/ha with a BCR of 2.09 in Virginia cultivar and Rs 11786/ha with a BCR of 2.05 in Spanish cultivar under the farmers practice. The increase in net returns was 24.7% in

Spanish and 10.5% in Virginia cultivars over the gross returns recorded under the farmers practice (Fig. 8 and 9).

Fig. 8 Effect of improved technology on yield and economics of Virginia groundnut at Junagadh during 2004

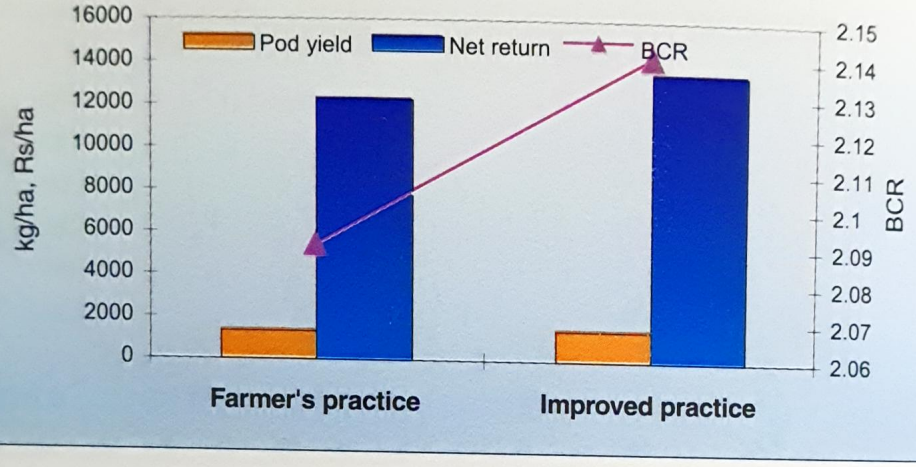
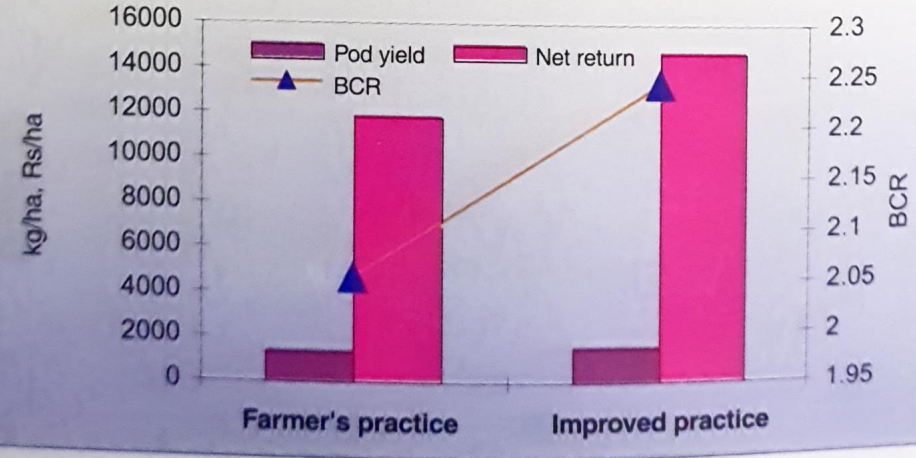


Fig. 9 Effect of improved technology on yield and economics of Spanish groundnut at Junagadh during 2004



Thus, simply adopting improved method of moisture conservation, a low cost technology, and replacing local cultivar with an improved cultivar will give not only higher yield but also increase monetary benefit in rainfed groundnut cultivation. This is a simple technology that can be adopted by the farmers with the help of their existing farm implements without any change in traditional method of cultivation.

8.2. Kadiri (Alfisols)

8.2.1. Yield

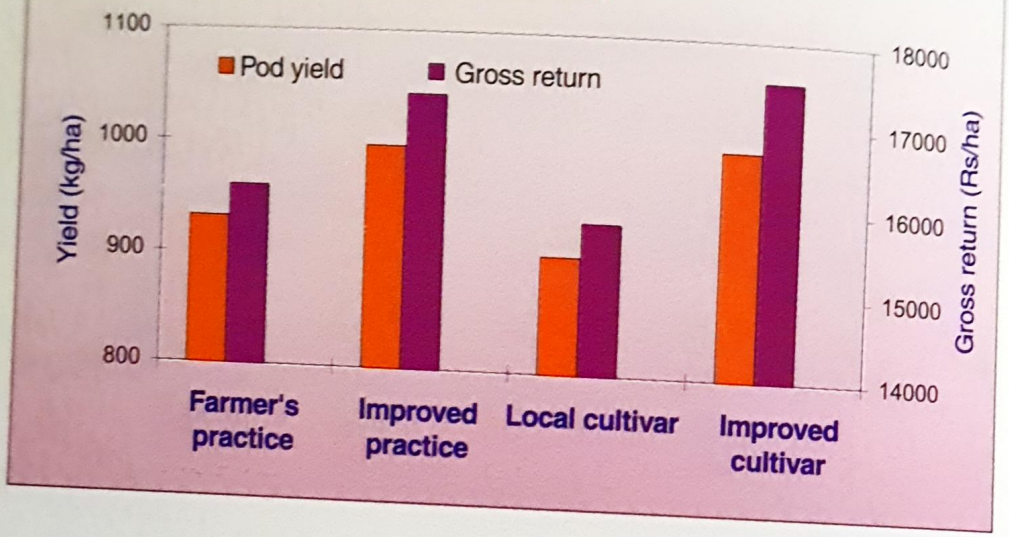
In 2000, improved cultivar K-134 was superior to local cultivar JL-24 and recorded 11% higher pod yield over the JL-24 (994 kg/ha, table 7). Combination of improved method of moisture conservation along with balanced fertilizer and cv K-134 resulted in 19.3% increase in pod yield over the farmer practice under cv JL-24.

Table 7: Effect of improved moisture conservation & fertilizer and improved variety on pod and haulm yields of groundnut at Kadiri during 2000.

Treatments	Pod yield (kg/ha)	Haulm yield (kg/ha)
T1	947	910
T2	971	940
T3	1058	977
Mean	**994**	**943**
T4	1061	970
T5	1039	980
T6	1209	1024
Mean	**1103**	**991**
S.E. ±	47	--
C.D. (0.05)	142	--

Pooled results of two years (2001-2002) clearly established the superiority of improved cultivar to local variety of groundnut. Cultivar K-134 gave pod yield of 1003 kg/ha that was 10.8% higher than local cultivar JL-24. However, yield increase under improved method of moisture conservation was not very high (6.1%) over the farmers practice. Adoption of improved method of moisture conservation along with improved cultivar (K-134) increased pod yield by 17.8% over the farmer's practice of moisture conservation under local cultivar, JL-24 (Fig. 10).

Fig. 10 Effect of cultivars and moisture conservation on yield and economics of groundnut at Kadiri (2001 & 2002)



8.2.2. Economics

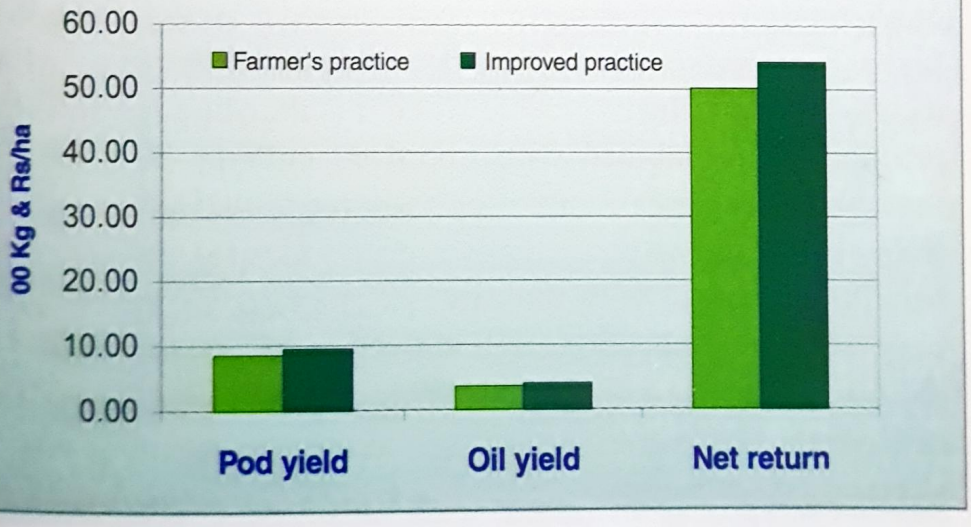
Adoption of improved cultivar gave higher gross returns of Rs. 17540/ha, which was 11.0 % higher that that recorded in local cultivar JL-24 (Fig. 10). Combination of improved method of moisture conservation and cultivar K-134 increased gross returns by 17.6% over the farmers practice under local cultivar. Higher BCR of 1.48 was recorded under improved practice as against the BCR of 1.26 under the farmers practice.

8.2.3. Demonstrations

Field demonstrations were conducted during kharif 2003 in Anantapur district with improved cultivar K-134 adopting improved method of moisture conservation and fertilizer application against the farmers practice with local cultivar JL-24.The improved technology resulted in higher pod yield (943 kg/ha) over JL-24 with farmers practice (850 kg/ha). The increase in pod yield under improved technology was to the extent of 11% over the farmers practice. The total oil yield also increased by 11.2% under the improved technology compared with the farmers practice (357 kg/ha).

The improved technology was economically viable as higher net returns of Rs 5427/ha was recorded under the improved technology, which was 8.3% higher than that recorded under the farmers practice (Fig. 11). The improved technology also had higher benefit-cost ratio (1.41) than that under the farmers practice (1.39). Thus, the large field demonstrations carried out in the farmers fields clearly established the superiority of improved technology to the farmers practice by not only giving higher pod and oil yields but was economically viable too in the drought prone area of the Rayalseema region.

Fig. 11 Effect of improved technology on yield and economics of groundnut at Kadiri (2003)



9. Impact study

The impact studies undertaken after completion of three years of field experimentations revealed that the farmers of the Saurashtra region are convinced about improved method of moisture conservation, as many farmers have started adopting moisture conservation methods. In the drought year of 2004, many farmers even in near by villages have adopted improved methods of moisture conservation just by opening moisture conservation furrow after 3 rows of groundnut. The impact was clearly visible, as the crop with improved method of moisture conservation did

not show wilting symptoms even after about one month of severe drought, where as the crop was totally wilted in the field where no moisture conservation measures were adopted. Improved cultivar namely, GG-5 (Spanish) and GG-13 (Virginia) gave consistently higher yield over the local cultivars and hence, the farmers are highly convinced about superiority of these cultivars to local variety. Many farmers have adopted these new cultivars in place of local varieties in the region.

The Rayalseema region of Andhra Pradesh is a drought prone area, hence the improved moisture conservation practice did not have strong impact on increasing the productivity of groundnut. However, tined cultivation with the existing plough helped in conserving more soil moisture (Fig. 12). The cultivar K-134 consistently showed its superiority to the local cv JL-24 due to its higher yield even under severe drought year. The impact of the technology was clearly visible when this moisture conservation practice was combined with improved cultivar (K-134). The farmers are very much convinced and have started adopting these technologies due to consistently higher pod yield and economic benefits compared with the farmers practice. However, large-scale seed multiplication of improved cultivars like K-134 is required so that the quality seed of new cultivars is made available easily to the farmers.

Fig. 12. Inter-row tined cultivation in Alfisols of Anantpur district, A.P.

10. Recommendations

Junagadh:

- In Saurashtra region of Gujarat for efficient in-situ moisture conservation in rainfed groundnut, one furrow after every 3 rows of groundnut should be opened for inter-row water harvesting. The furrow may be deepened by running plough when ever necessary.

- Nitrogen @12.5 kg/ha in the form of ammonium sulphate and phosphorus @ 25.0 kg/ha in the form of single super phosphate may be applied in the furrow at the time of sowing. Gypsum @ 500 kg/ha, half at the time of sowing in the furrow and remaining half at peak flowering stage of the crop as top dressing should be applied.

- Improved cultivar namely GG-5 (Spanish) and GG-13 (Virginia) should be grown instead of local cultivar for higher productivity under rainfed situation.

- Cultivation of groundnut in shallow soil (less than 22.5 cm depth) may be avoided as it is not found remunerative

Kadiri:

- Cultivar K-134 has established its edge over the local cultivat JL-24; hence its cultivation should be promoted for higher productivity.

- Inter row tined cultivation for insitu moisture conservation should be promoted for better conservation of in-situ soil moisture and higher productivity in rainfed condition.

11. Perspectives

The demand for oilseeds in the year 2020, at the present consumption rate, is estimated to be about 34 million tonnes. The present contribution of groundnut to total oilseeds is about 40%. Assuming that groundnut will account for a similar percentage of total oilseeds production, the total demand for groundnut will be about 14 million tonnes by 2020 AD, thus, the gap of about 5.8 million tonnes has to be bridged by improving the production. Gujarat and Andhra Pradesh are the major groundnut producing states in the country where groundnut is grown mainly under rainfed condition. The productivity of groundnut in these states fluctuates vigourously mainly due to insufficient and erratic rainfall received during the crop growth period. Increasing irrigation facility for enhancing groundnut productivity may not be possible in near future. Thus, the crop will remain under rain dependent condition facing vagaries of monsoon. Adoption of efficient in-situ moisture conservation along with improved cultivar will go a long way to stabilize the production of groundnut in these two states in particular and in the country in general. Further, development of short duration and drought tolerant cultivar for early, mid and end season drought should be a prime research priority for groundnut research programme in the country.

12. Further Reading:

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Mid Term Review Workshop held at NRCG, Junagadh

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