

Status of Adoption of Improved Groundnut Technologies in Odisha State

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1. OPEC Fund for International Development (OFID)

2. Rashtriya Krishi Vikas Yojana (RKVY), Government of Odisha

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1. Groundnut area, production and productivity trends in Odisha state

Paddy is the dominant staple crop in the state of Odisha in India. Groundnut, sesame, mustard and niger are the major oilseed crops cultivated in the state. Groundnut occupied about 34% of total oilseed area and contributed more than 68% of total oilseeds production during the triennium ending (TE) 2017-18. The area under groundnut declined from 318,000 ha to 210,000 ha between TE 1995-96 and 2017-18 (25 years) (Behura et al 2014, Odisha Agricultural Statistics - various issues. <https://agriodisha.nic.in/Home/statistics>). It has registered a negative growth rate (cropped area) of 0.93% per annum. Production too declined from 466,000 tons to 374,000 tons during the same period. However, groundnut productivity saw an uptrend from 1465 kg/ha to 1783 kg/ha due to the introduction of modern high-yielding varieties. Figure 1 shows the trends in area, production and productivity of groundnut in the state.

Groundnut is grown both during *Kharif* (rainy) and *Rabi* (post-rainy) seasons. The area under *Rabi* groundnut comprises 67% of the total groundnut area and is mostly grown under residual moisture conditions. A significant decline in groundnut area was observed from 164,000 ha in 1993-94 to 65,000 ha in 2017-18 in *Kharif* and from 166,000 ha to 133,000 ha in *Rabi* during the same period. Bargarh district registered the largest decline in area from about 50,000 ha to 20,600 ha during the study period. All the major groundnut producing districts – Balangir, Cuttack, Jagatsinghpur, Jajpur, Kendrapara, Dhenkanal, Angul, Ganjam and Bargarh – experienced a shift in area under groundnut during the same period. Non-traditional groundnut growing districts such as Balasore, Subarnapur, Kalahandi, Kandhmal, Boudh, Keonjhar, Koraput, Nabarangpur, Deogarh and Mayurbhanj registered a marginal area expansion under the crop. The major and minor groundnut growing districts in Odisha are shown in Figure 2.

The decline in groundnut area has been mainly due to unstable markets and climatic factors. The non-availability of quality groundnut seeds to sow immediately after the harvest of autumn rice has been largely responsible for the poor area allocated to groundnut in coastal Odisha during the *Rabi* season. Early cessation of monsoon resulting in moisture depletion during *Rabi* has curtailed area expansion. Groundnut yield registered a growth rate of 1.87% per annum. However, the crop also maintained an annual production growth rate of 0.92% despite area decline by 0.93% per annum during the study period. It is hypothesized that the adoption of improved groundnut varieties and recommended package of practices might have led to higher yields at the farm front.

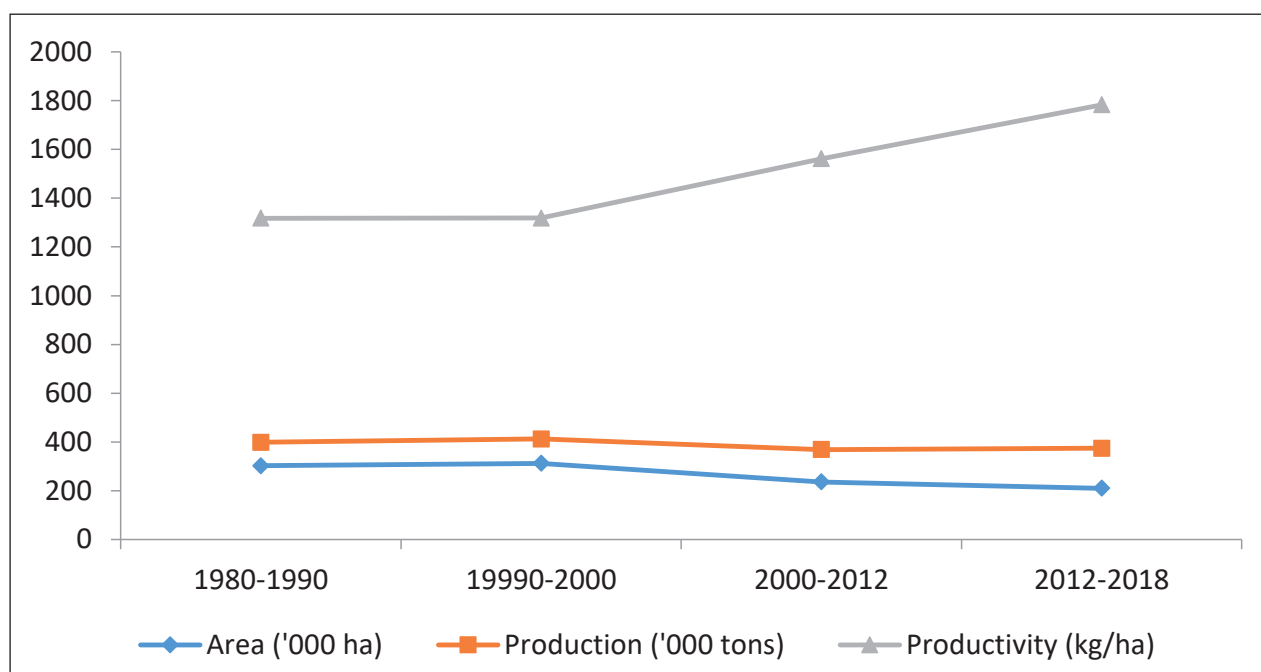


Figure 1. Trends in area, production and productivity of groundnut in Odisha state.



Figure 2. Major and non-traditional groundnut growing districts in Odisha.

2. Varieties cultivated in Odisha state

A number of improved groundnut varieties have been released/identified as suitable for cultivation in the state. Varieties such as Kissan (OG 13-3), Jawan (OG 71-3), Smruti (OG 52-1) and Devi (ICGV 91114) were developed/identified by Odisha University of Agricultural Technology (OUAT) and released for commercial cultivation. Other popular varieties commonly cultivated in the state are AK 12-24, Kadiri 6, TAG 24, ICGV 00351 and TPG 41. AK 12-24 is one of the oldest varieties that was released in 1940 and is still preferred by farmers in a few pockets of the study districts. The other varieties recommended for cultivation include GJG 18 (JSP-49), Girnar 3 (PBS 12160), Vijetha (R 2001-2), TG 51, Vasundhara (Dh 101), Kaushal, Mallika (ICGH 00440), Pragathi (RHSY 1), Prutha (Dh 86), TG 37A and TG 38B (TG 38) (<http://variety.dgr.org.in/Searching.aspx>). Of these, GJG 18 (JSP-49), Girnar 3 (PBS 12160), Vijetha (R 2001-2), TG 51 and Vasundhara (Dh 101) were released for cultivation since 2007 in the state by the Central Varietal Release Committee (CVRC) (<http://oilseeds.dac.gov.in/Variety/Groundnut.aspx>).

3. Release of Devi (ICGV 91114) in Odisha in 2008

Groundnut variety ICGV 91114 developed by the International Crops Research Institute for the Semi-Arid Tropics was introduced in Anantapur in 2002 through farmer participatory varietal selection (FPVS) along with 10 other varieties as an alternative to TMV2 which was occupying 75-80% of the total groundnut area

in the district. ICGV 91114 is a short-duration, drought-tolerant, Spanish Bunch variety that matures in 95-100 days during the *Kharif* season and 100-110 days during the *Rabi* season. It was derived following bulk pedigree method from a cross between ICGV 86055 and ICGV 86533.

ICGV 91114 was highly preferred by farmers of Anantapur due to its high pod and haulm yields, medium-to-large kernels, uniform maturity and its ability to tolerate mid-season and terminal drought. ICGV 91114 gave 23% (2004-05 to 2008-09 testing season) higher mean yield than TMV 2. Even though ICGV 91114's cost of production per hectare is 23% more than that of TMV 2, it provides 36% higher net returns per hectare. Also, the yield variability of ICGV 91114 was lower by 30% compared to that of TMV 2 (Birthal et al. 2011). Further, when groundnut haulms from ICGV 91114 were fed to cattle, milk production increased by 11% over the local check TMV 2. The variety was approved for release in Andhra Pradesh by the Andhra Pradesh State Seed Sub-Committee in 2006 and was notified in The Gazette of India in July 2007. The variety was subsequently released as Devi in Odisha in 2008 and as ICGV 91114 in Karnataka in 2009.

Later, under an International Fund for Agricultural Development (IFAD) project (2002-2006), ICRISAT in collaboration with Odisha Tribal Empowerment and Livelihoods Program (OTELP), introduced several new improved groundnut varieties from which farmers selected ICGS 44, TAG 24, ICGV 91114 and Smruti through farmer participatory varietal selection trials (FPVST). After testing for three seasons (2006-2007), ICGV 91114 named 'Devi' was preferred by tribal farmers due to its 30% yield advantage over the local variety (OTELP report, 2011). The introduction of these modern varieties catapulted the average yield of *Kharif* groundnut in Koraput from 732 kg/ha to 1024 kg/ha and that of *Rabi* groundnut from 965 kg/ha to 2683 kg/ha. Similarly, groundnut yield in Dhenkanal increased by 61-64%, to 1434 kg/ha in *Kharif* and 1944 kg/ha in *Rabi* seasons. Farmers' additional incomes ranged from ₹ 6000-8000/ha during *Kharif* and ₹ 15,000-20,000/ha during *Rabi*.

At the research station trials carried out by OUAT, variety Devi recorded 14.78% greater yield in 2005 and 23.76% in 2006 over the best local check TMV 2. Compared to popular variety Smruti that matures in 100-105 days, Devi matured in 95 days during both *Kharif* and *Rabi* seasons during trials conducted at Bhubaneswar, Semiliguda and Koraput districts. During the IFAD project, through partnership between OTELP and ICRISAT, and contributions from state trials conducted by OUAT, Devi was identified as a farmer-preferred variety and released for cultivation in Odisha state in 2008.

4. Formal and informal seed systems support popularization of variety Devi under bilateral projects (IFAD, TL II, OFID and Govt of Odisha)

ICRISAT has collaborated with OUAT and the Department of Agriculture (DoA) to enhance the adoption of Devi in the state. As part of the Tropical Legumes II (TL II) project (2007/08-2012/13) funded by the Bill & Melinda Gates Foundation, seed system interventions were aimed at promoting the large-scale adoption of Devi through formal seed chains. Breeder Seed (BS) production was taken up by OUAT, and Foundation Seed and Certified Seed (FS and CS) by the State Seed Corporation (SFC), State DoA, Oilseed Growers Federation and NGOs (Monyo and Gowda 2014). Initially, 800 kg of Breeder Seed were supplied by OTELP to Odisha State Seed Corporation (OSSC) Ltd during 2009-10; this facilitated a seed multiplication chain in the state. In 2011-12, OSSC supplied 135.6 tons of Devi seeds to farmers; its coverage increased to 180 ha in the OTELP area as against 2006-07 when it was nil (OTELP report 2011). The ongoing Rashtriya Krishi Vikas Yojana (RKVY) funded by the Government of Odisha and OPEC Fund for International Development (OFID) project built on the leads from the two previous projects to undertake the large scale production of Nucleus Seed (NS), BS, FS and CS formally and Truthfully Labelled Seed (TL) informally. Seed production in the formal and informal sectors resulted in farmer access to good quality seeds of Devi during sowing time. Under this project, around 32,000 kg of BS of ICGV 91114 was supplied by ICRISAT to OSSC during 2017-18. Besides this, ICRISAT is also supporting farmers by providing seeds of ICGV 91114 to take up seed production on their farms. The RKVY and OFID project interventions were undertaken in the four districts of Kalahandi, Ganjam, Bolangir and Nuapada from 2015 to 2021.

5. Objectives of the adoption study and sampling

Following the identification of farmer preferred variety Devi, its release in 2008 and the multi-institutional support to formal and informal seed systems, efforts were made to track and study the extent of adoption of improved groundnut varieties (specifically Devi), the economic benefits that accrued to farmers through their adoption, and the extent of adoption of components of recommended practices by groundnut farmers. A study analyzed the adoption of improved groundnut varieties and technologies among farmers of Odisha and also estimated the economics of groundnut farming during 2017-18. A field survey was conducted from November 2017 to June 2018 covering both *Kharif* and *Rabi* seasons of 2016-17, across 10 major groundnut growing districts of Odisha state. Five coastal (Cuttack, Ganjam, Jajpur, Khordha and Puri) and five inland groundnut growing districts (Balangir, Bargarh, Dhenkanal, Kalahandi and Nuapada) were selected for the study. Stratified random sampling was employed to select the respondents. At the village level, farmers were randomly selected from a list of groundnut cultivators developed from multiple sources. Overall, the survey covered about 906 groundnut growers¹ comprising 287 marginal (32%), 383 small (42%) and 236 large (26%) farmers from 110 villages in 46 community development blocks (Table 1). The procedure used to select the sample is depicted in Figure 3.

The proportion of marginal, small and large farmers to the total district sample was the highest in Ganjam (42%), Dhenkanal (57%) and Bargarh (44%) districts, respectively. Groundnut being cost intensive, majority of the sample farmers belonged to small and large categories rather than the marginal category. The relative affordability of high input expenditure per hectare was higher for small and large category farmers.

Table 1. District-wise sample and category of groundnut farmers covered in the study.

Sl. No.	District	No of blocks	No of villages	Marginal farmers	Small farmers	Large farmers	Total
1	Balangir	4	9	27(33)	29(36)	25(31)	81
2	Bargarh	6	20	12(10)	53(45)	52(44)	117
3	Cuttack	4	11	27(33)	40(49)	14(17)	81
4	Dhenkanal	4	8	27(31)	49(57)	10(12)	86
5	Ganjam	6	11	39(42)	40(43)	13(14)	92
6	Jajpur	5	11	31(35)	35(40)	22(25)	88
7	Kalahandi	4	9	21(23)	36(40)	33(37)	90
8	Khordha	3	6	29(36)	30(38)	21(26)	80
9	Nuapada	4	12	35(38)	34(37)	22(24)	91
10	Puri	6	13	39(39)	37(37)	24(24)	100
Total		46	110	287(32)	383(42)	236(26)	906

Note: Figures in the parentheses are the percentage of farmers to the total farmers in the respective districts.

¹ Farmers with land holdings less than and equal to 2.5 acres, between > 2.5 acres and 5 acres and > 5 acres were categorized as marginal, small and large farmers, respectively in the present study.

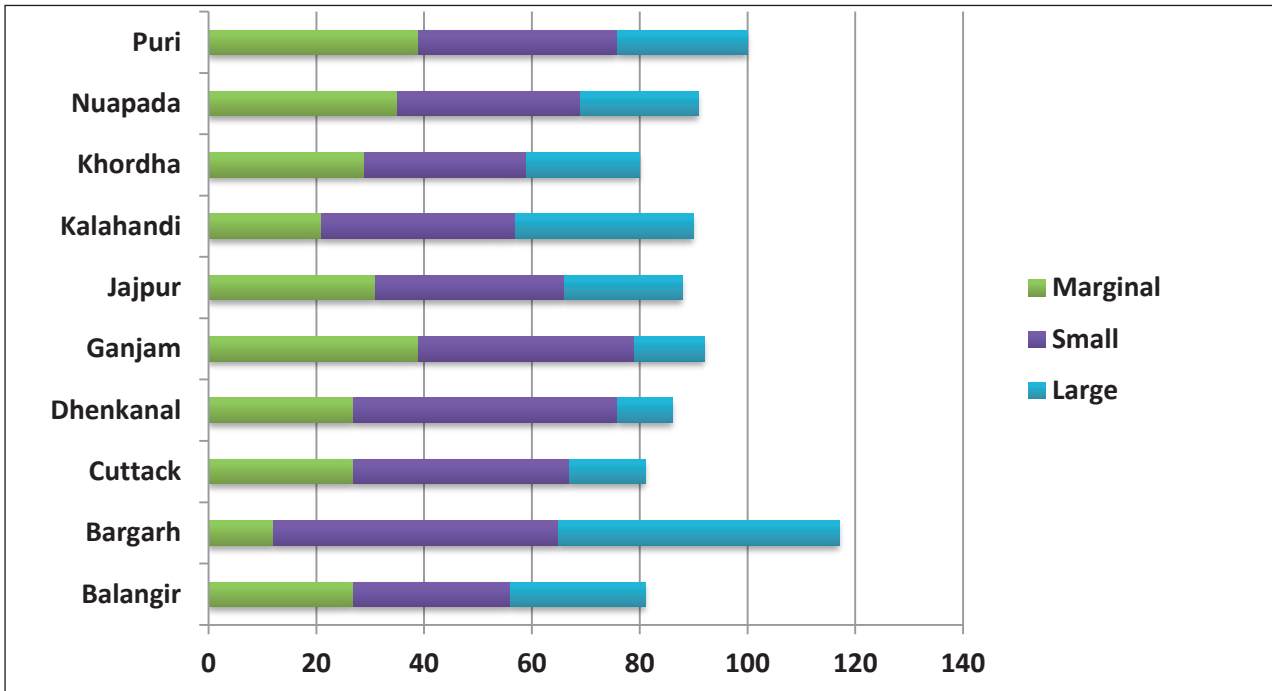


Figure 3. Composition of sample farmers in the study districts.

6. Socio-economic profile of groundnut farmers

The socio-economic profile in Indian villages is still determined by the caste system. So the study sample was categorized into General category, Other Backward Caste (OBC) and Scheduled Caste and Scheduled Tribes (SC&ST). SC&ST farmers in the study villages in general have a lower socio-economic status compared to other categories. About 44% of the surveyed groundnut farmers were from the OBC category, followed by the General category (36%) and SC&ST (10% each) (Figure 4). About 56% of the sample farmers fell under the age group of 41 to 60 years; 24% were >60 years and 20% were between 15 and 40 years. In terms of literacy, 54% of the respondents had completed their secondary schooling, 13% had completed primary schooling, 8% had completed Intermediate level, 7% were graduates or above and the rest (18%) had not received any formal education (Figure 5).

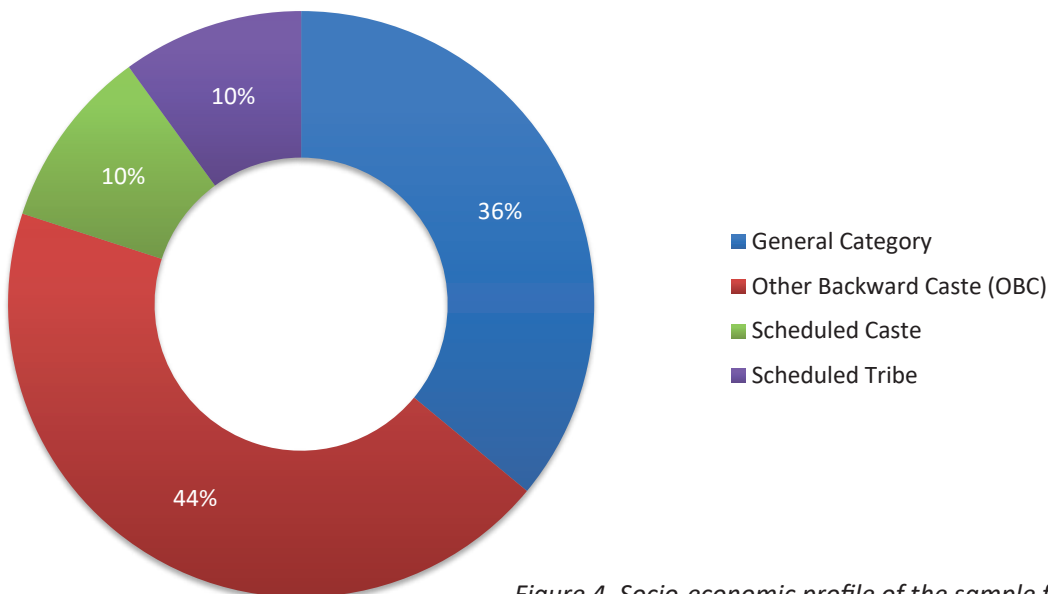


Figure 4. Socio-economic profile of the sample farmers.

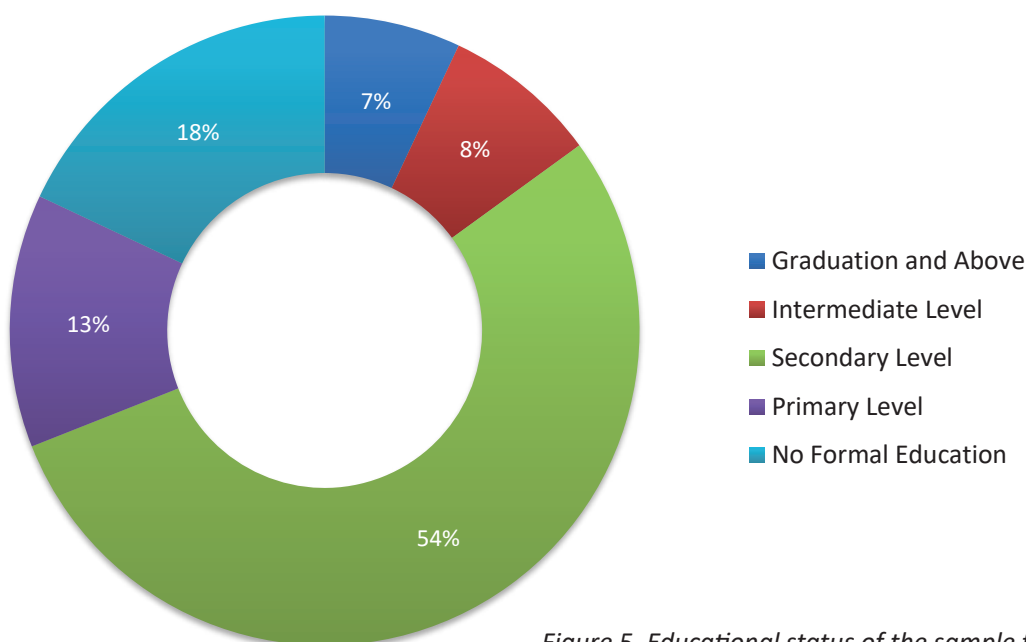


Figure 5. Educational status of the sample farmers.

Farming was the major primary occupation among 99% of the respondents. In terms of secondary occupation, non-farm wage was practiced by 21% of the farmers, 19% were involved in livestock rearing, 18% were off-farm labour, 6% were engaged in business and 5% held salaried jobs. About 13% of the respondents were non-farm wage earners, followed by livestock rearing (6%), off-farm labour (2%) and business (1%).

The total mean annual income from different sources was estimated at ₹ 143,440 per household. The income of marginal farmers was low at ₹ 95,830 compared to that of small and large farmers at ₹ 125,310 and ₹ 229,766, respectively. Crop husbandry contributed 53% of the total income; varying from 30% among marginal farmers to 67% among large farmers. Income from salaries stood at 12%, followed by business (9%), non-farm wage earnings and livestock rearing (8% each) and off-farm wage earnings (4%) during 2016-17. The remaining 6% came from pension, remittances and caste-based occupations.

Farm and non-farm work contributed to 32% of the income of marginal farmers; this declined to 14% for small farmers and 1% for large farmers. Income from livestock rearing was 9% for small and marginal farmers and 6% for large farmers. Business income stood at 12% for large farmers, 9% for small farmers and 6% in the case of marginal farmers. Salaries contributed 14% to marginal farmers' annual incomes, followed by 11% for small and large farmers. The share of groundnut to the total income was estimated at 21% and varied from 17% to 23%.

7. Trends in area allocated to groundnut cultivation

District-wise cropped area available per household and the area allocated to groundnut cultivation during *Kharif* 2016 and *Rabi* 2016-17 by the sample farmers are summarized in Figures 6 and 7. Of the total of 0.8 acres and 1.8 acres of land holdings per household during *Kharif* and *Rabi*, respectively, only 0.6 acres (75%) and 1.6 acres (89%) were utilized for cultivation. During *Kharif*, groundnut cultivation was concentrated in the inland districts of Balangir, Bargarh, Dhenkanal, Kalahandi and Nuapada. Coastal districts other than Ganjam did not allocate any area. In terms of area covered, Bargarh district allotted a maximum of 1.9 acres during *Kharif* while Jajpur district allotted 3.3 acres in *Rabi*. Farmers Balangir, Dhenkanal, Ganjam and Nuapada utilized 100% of the land for groundnut cultivation during *Kharif* while only Balangir and Nuapada could do so in *Rabi*. The survey showed that out of the total area allocated to groundnut, only about 27% was under *Kharif* and the rest under *Rabi*. Only about 5% and 21% of the groundnut cropped area were irrigated during *Kharif* and *Rabi*, respectively.

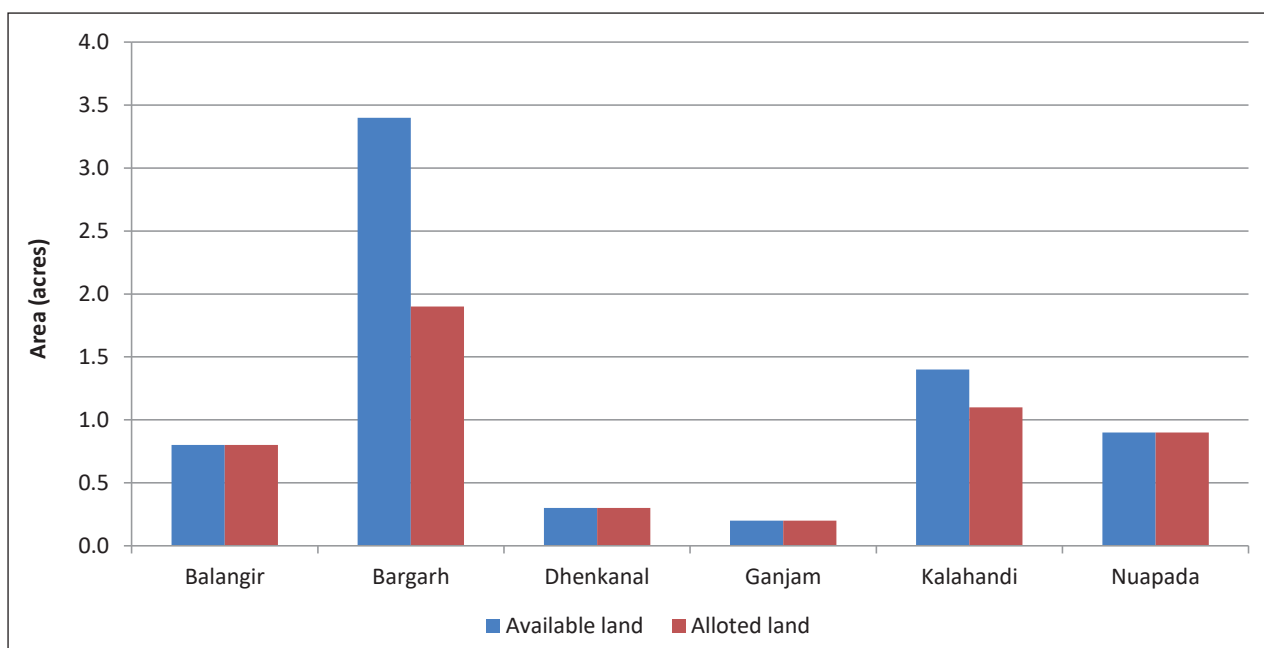


Figure 6. Area allocated to groundnut by respondent farmers in different districts of Odisha during Kharif 2016.

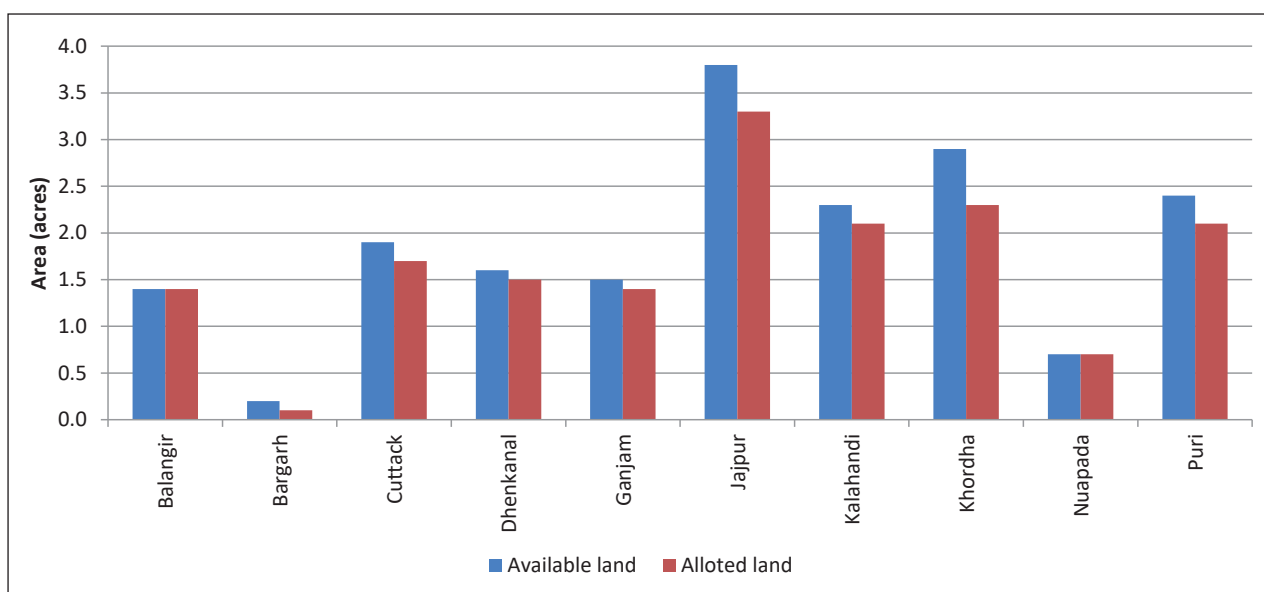


Figure 7. Area allocated to groundnut by respondent farmers in different districts of Odisha during Rabi 2016-17.

A decline in the area allocated to different groundnut varieties has been observed from 2013-14 to 2017-18 (Table 2). The decline was sharper in *Kharif* than in *Rabi* seasons. The share of AK 2-24 to the total groundnut area sown declined from 24% in 2013-14 to 14% in 2017-18 during *Kharif* and from 16% in 2013-14 to 10% in 2016-17 during *Rabi*. In contrast, the area under Devi increased from 7% to 31% in *Kharif* and from 2% to 22% during *Rabi*. The area allocated to Kadiri 6 more than doubled from 6% to 13% during *Kharif*. In *Rabi*, it increased by 3% from the base year, i.e. from 9% in 2013-14 to 12% during 2016-17. In the case of Smruti, the area fell from 16% during *Kharif* 2013-14 to 10% in 2017-18, and from 5% during *Rabi* 2013-14 to 3% during 2016-17. There was no change in area sown to TAG 24 over the years. TG 37 and TG 38 which were introduced very recently by the Department of Agricultural and Farmers' Empowerment, Government of Odisha, covered about 0 to 1.6% of the groundnut area from 2013-14 to 2017-18. Though one of the oldest varieties TMV 2 was still being grown on about 6% of the groundnut area during *Rabi* 2016-

17, however its presence declined from 5.4% during *Kharif* 2013-14 to 0.4% during 2017-18. The share of unknown groundnut varieties that commanded almost one-third of the area during *Rabi* 2013-14 declined to 20% during 2016-17, testifying to greater farmer awareness over the years about new technologies, particularly varieties. During *Kharif*, the contribution of unknown varieties declined from 26% in 2013-14 to 15% in 2017-18.

Table 2. Groundnut varietal transition over season and time.

Variety	Percent area covered								
	2013-14		2014-15		2015-16		2016-17		2017-2018
	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi	Kharif
AK 12-24	23.7	15.5	23.4	14.5	16.7	11.2	15.7	9.5	14.0
Devi	6.8	2.3	10.7	5.0	23.2	11.4	31.3	21.5	30.9
G2	0.0	7.3	0.0	7.7	0.0	8.0	0.0	6.4	0.0
G5	0.0	6.6	0.0	7.1	0.0	7.5	0.0	7.5	0.0
G6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
GUJARATI	0.0	1.4	0.0	1.6	0.0	1.7	0.0	1.8	0.0
ICGV 00351	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.5	2.5
JAL 24	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2
Kadiri 6	6.3	9.2	8.6	10.2	7.1	10.8	11.3	11.4	13.1
Local	6.5	5.1	6.6	5.1	6.5	5.4	6.2	5.3	6.1
Smruti	16.0	5.0	15.3	4.4	11.9	3.9	10.0	2.9	10.4
TAG 24	4.4	5.0	3.7	5.2	5.6	5.8	4.3	4.6	4.1
TG 38	0.0	0.5	0.0	0.7	0.2	0.6	1.3	0.8	1.6
TG 37	0.0	0.2	0.0	0.9	0.0	1.1	0.0	1.3	0.0
TG 51	0.0	0.0	0.0	0.0	0.2	0.0	0.3	0.0	0.3
TMV 2	5.4	9.0	1.8	7.2	0.5	5.9	0.4	6.5	0.4
TPG 41	4.9	0.3	4.6	0.3	3.3	0.0	2.0	0.0	1.8
Unknown	26.1	32.8	25.1	30.2	25.0	26.7	15.4	19.5	14.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

8. Major varieties and their productivity levels

A number of improved groundnut varieties have been released/identified as suitable for cultivation in the state of Odisha following national and state testing trials. Varieties such as Kissan (OG 13-3), Jawan (OG 71-3), Smruti (OG 52-1) and Devi (ICGV 91114) were developed/identified by Odisha University of Agricultural Technology (OUAT) and released for commercial cultivation. Other popular varieties commonly cultivated in the state are AK 12-24, Kadiri 6, TAG 24, ICGV 00351 and TPG 41. Of these when considering the gross cropped area for the year 2016-17, Devi (24%) had the highest allocated area followed by Kadiri 6 (12%), AK 12-24 (11%), Gujarat varieties (12%), TMV 2 (5%), Smruti and TAG 24 (4.5% each), local varieties (6%), unknown varieties (18%) and others (ICGV 00351, TG 37, TG 38 and TPG 41- 3%) (Figure 8).

Among the varieties, Devi had the highest area allocated (31%), followed by AK 12-24 (15%), Kadiri 6 (12%), Smruti (10%), local (7%), TAG 24 (4%), ICGV 00351 and TPG 41 (2% each) during *Kharif* (Figure 9). Unknown varieties contributed 15% to the total area under *Kharif* groundnut during 2016. Devi was the most preferred variety in Balangir, Bargarh, Kalahandi and Nuapada where its total acreage ranged from 20-50%. In Balangir, Kalahandi and Nuapada, ICRISAT through a collaborative project with the Government of Odisha, had engaged farmers in seed production of Devi, which may have contributed to the high acreage of Devi. Apart from Devi, local spreading type varieties contributed >15% of the area in Balangir and Nuapada districts. Bargarh district is considered a seed hub from where seeds are supplied to coastal districts for cultivation during *Rabi*. A major area in this district was allocated to Kadiri 6 and Smruti (23% each), followed by Devi (21%), mainly because of the high seed demand of these varieties in coastal Odisha during *Rabi*. Kadiri 6 (40%), AK 12-24 (32%) and Devi (22%) were the dominant varieties in Ganjam. In Dhenkanal, AK 12-24 (32%) was the dominant variety followed by unknown varieties (30%) during *Kharif* 2016. Besides cultivated varieties, new varieties such as TG 38 and TPG 41 have also been popularized by the Odisha State Seeds Corporation Ltd. (OSSC Ltd.) through its seed production programs.

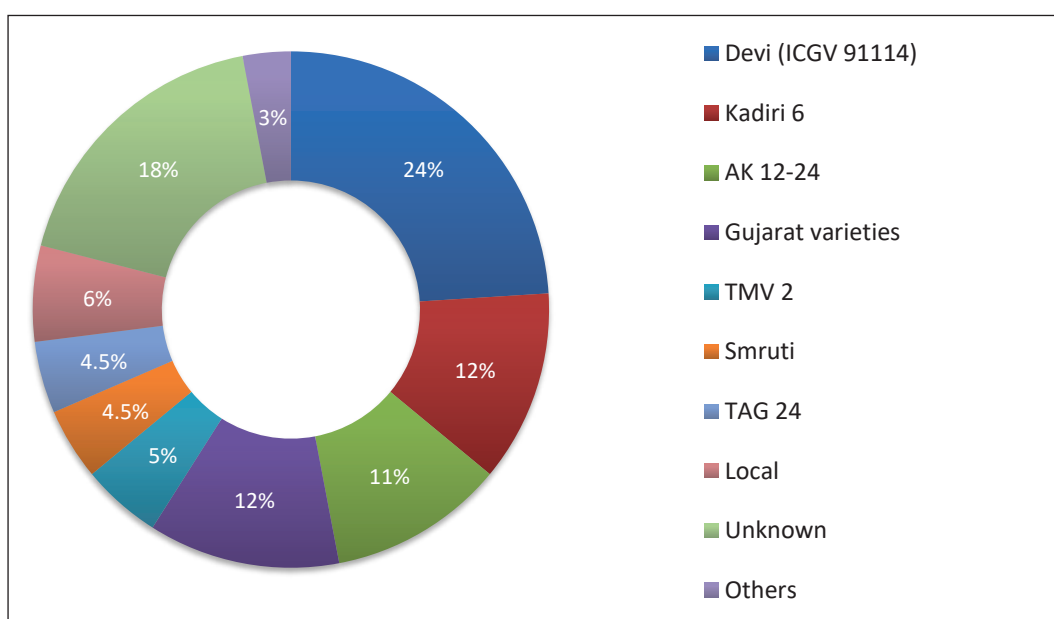


Figure 8. Gross cropped area (in percent) occupied by major groundnut varieties in Odisha state during 2016-17.

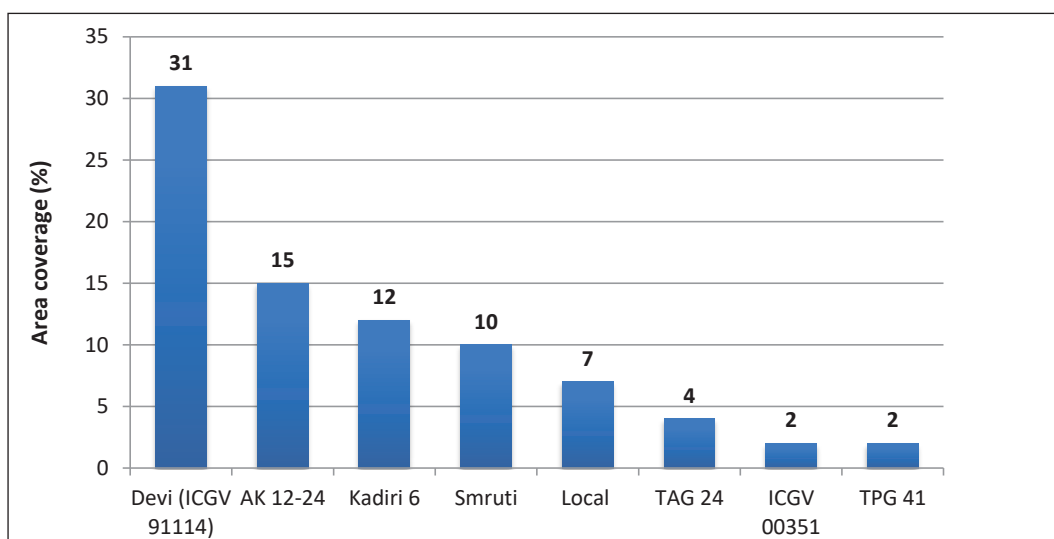


Figure 9. Area covered by major groundnut varieties in Odisha state during Kharif 2016.

During *Rabi* 2016-17, variety Devi contributed to 22% of the area across the districts followed by unknown varieties (20%) (Figure 10). The other popular varieties included Kadiri 6 (12%), AK 12-24 (10%), G5 (8%), TMV 2 and G2 (6% each), Local and TAG 24 (5% each) and Smruti (3%). While the area allocated to Devi was found to be the highest in Balangir (50%), Kalahandi (45%), Puri (31%) and Khordha (27%), Kadiri 6 had the highest area allocated in Bargarh (67%), Ganjam (47%) and Dhenkanal (30%) districts. In Jajpur district, groundnut varieties from Gujarat such as G2 and G5 with 25% and 38% area allocation were the dominant varieties. Early planting in Jajpur compared to other districts and the non-availability of *Kharif* harvest materials means that farmers have to rely on groundnut seed traders for their seed requirements. Since seed traders procure seeds from Gujarat, Maharashtra, Karnataka and Andhra Pradesh through commission agents, the varieties cultivated by farmers in Jajpur reflect the varieties of seeds procured by these traders. A similar process was observed with seed traders from other coastal districts such as Puri, Khordha and Cuttack. In Cuttack, unknown varieties were cultivated in 64% of the area mainly due to farmers' dependence on local seed traders to procure seeds. In Puri, Devi was preferred over other varieties as it is newly released and part of the seed chain of the state. Variety Smruti developed by OUAT is mainly cultivated in the coastal districts during *Rabi*, with seeds procured from the *Kharif* grown crop in Bargarh district. Smruti is a very popular variety with attractive kernel color and fetches a premium price 5-10% higher than other varieties. AK 12-24 released in 1940 is still preferred among farmers of Puri, Dhenkanal and Nuapada districts.

The average productivity of groundnut during 2016-17 was 1069 kg/ha and 1898 kg/ha for *Kharif* and *Rabi*, respectively, while overall yield was estimated at 1688 kg/ha in the targeted districts. Variety-wise yield estimates for *Kharif* 2016 indicated that TG 38, followed by TPG 41 and TG 51, recorded high yields of 2052 kg/ha, 2038 kg/ha and 1976 kg/ha, respectively. These varieties were grown under the seed multiplication program of OSSC Ltd. The other varieties with high yields were Smruti (1412 kg/ha), Devi (1075 kg/ha), ICGV 00351 (1081 kg/ha) and AK 12-24 (1027 kg/ha). The remaining varieties recorded yields <1000 kg/ha. Among the districts, Kalahandi recorded the highest yield of 1139 kg/ha followed by Bargarh (1131 kg/ha), Nuapada (1011 kg/ha), Balangir (968 kg/ha), Dhenkanal (917 kg/ha) and Ganjam (862 kg/ha).

During *Rabi*, TG 37 recorded the highest yield of 3001 kg/ha followed by TG 38 (2204 kg/ha), G5 (2163 kg/ha), Smruti (2111 kg/ha), G6 (2089 kg/ha), TMV 2 (2050 kg/ha) and AK 12-24 (2069 kg/ha). Variety TG 37 was grown only in one village of Jajpur district which might have contributed to its superior yield performance.

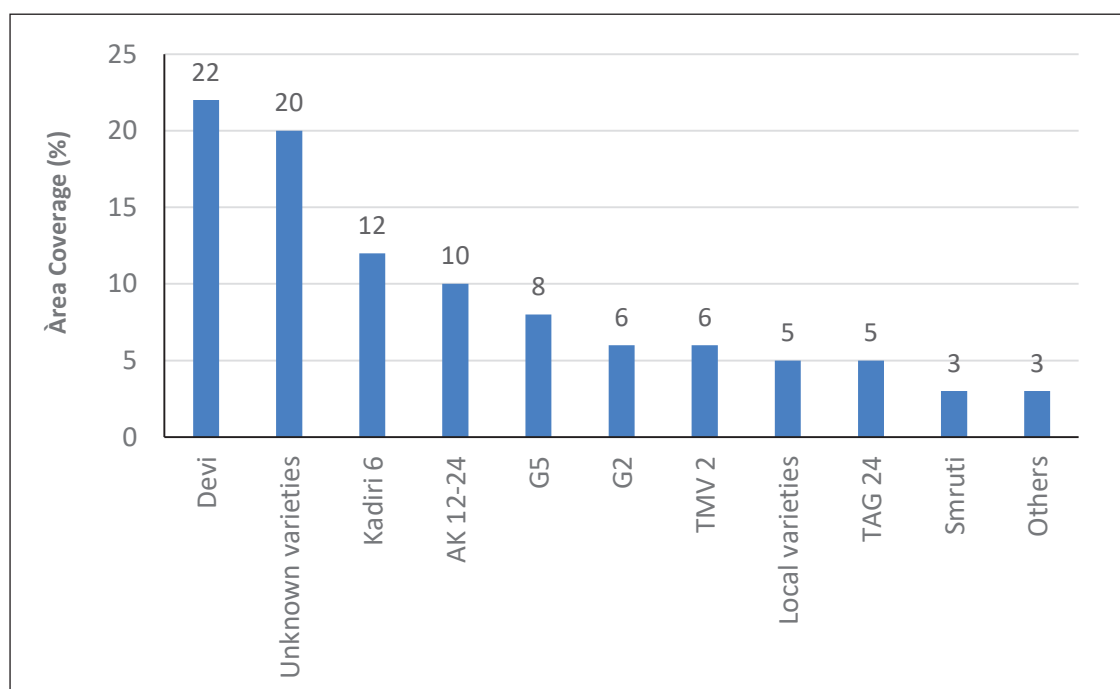


Figure 10. Area covered (in percent) by major groundnut varieties in Odisha state during *Rabi* 2016-17.

Other popular varieties such as ICGV 00351, Kadiri 6 and TAG 24 had yields of 1544 kg/ha, 1872 kg/ha and 1904 kg/ha, respectively. Though the area under Devi was high, its average yield was comparatively low at 1710 kg/ha. Local and unknown varieties registered average yields of 1340 kg/ha and 1888 kg/ha, respectively. Across the districts, groundnut productivity varied between 1381 kg/ha in Bargarh to 2241 kg/ha in Dhenkanal. The coastal districts recorded a productivity of ≥ 2 t/ha during *Rabi* 2016-17.

9. What attributes enable adoption of groundnut varieties in Odisha

High yield, easy and timely availability of seeds, drought tolerance, pest resistance, adaptation to local growing conditions and market preferences were the main attributes that enabled the adoption of modern groundnut varieties in Odisha. Among these easy and timely availability of seeds ranked among the top parameters for adoption of variety by the farmers. For example, Devi was grown mainly because of its high yield, drought resistance and availability of seeds to farmers through formal and informal systems. Among the studied districts Devi had the highest area allocations in Balangir (50%), Kalahandi (45%), Puri (31%) and Khorda (27%). In Puri district the preference over other varieties was due to high concentration of groundnut seed growers in this district. In Jajpur district, Gujarat varieties procured from mandis (APMC market yard) were found dominating. In Nuapada district local varieties were dominating, whereas in Cuttack majority area was occupied by groundnut seeds purchased from local seed traders. Similarly, Smruti, a local variety, was grown mainly because of its attractive kernel colour, premium price and high yield.

10. Where do farmers source groundnut seed

The percent contribution of different sources of groundnut seeds for farming in Odisha state during *Kharif* and *Rabi* season of 2016-17 is shown in Figures 11 and 12. In terms of seed procurement, majority of the respondent farmers used self-harvested seeds for sowing, ranging from 29% in Ganjam to 95% in Dhenkanal during *Kharif* and from 14% in Ganjam to 100% in Bargarh during *Rabi*. The use of self-harvested seeds was restricted to inland districts where groundnut is cultivated in both *Kharif* and *Rabi* seasons. In the coastal districts of Jajpur, Cuttack, Khordha and Puri where most of the cultivation is during *Rabi*, groundnut farmers mainly rely on government seed agencies or seed traders for their seed requirements. The Government's contribution in providing quality groundnut seed to farmers was restricted to 10%, irrespective of the season. About 2611410 Kg and 3728390 Kg of groundnut seed were provided through government outlets during 2017-18 and 2018-19, respectively. The seed replacement rate (SRR) was 8.79% during 2017-18 and 9.98% during 2018-19 (Seed Division, Directorate of Agriculture and Food Production, Government of Odisha). The role of seed traders in supplying groundnut seeds to farmers varied across the major districts ranging from 7% in Nuapada to 56% in Bargarh during *Kharif*, and from 23% in Balangir to 100% in Jajpur during *Rabi* season. The overall contribution of seed traders to the groundnut seed business in Odisha was 28% and 59% during *Kharif* and *Rabi* season, respectively. ICRISAT's contribution to seed sourcing, through its collaborative project with the Government of Odisha, ranged from 2% to 48% across seasons and four districts (Balangir, Kalahandi, Nuapada and Ganjam). Some groundnut seed producers registered under OSSC Ltd were found to have engaged groundnut farmers as contract growers in Puri and Khordha district to produce groundnut seed, which contributed 7% of total demand in the state. Besides these major sources, OUAT, Krishi Vigyan Kendras (KVKs) and fellow groundnut farmers contributed to the seed supply chain on a small scale.

The price of groundnut seeds ranged from ₹ 32 to ₹ 82 per kg across districts, seasons and farmers depending on the seed source. The Government's selling price for Certified groundnut seed was ₹ 84 per kg. However, it released a subsidy of ₹ 22 per kg through Department of Biotechnology (DBT) to farmers willing to purchase seeds from government dealers.

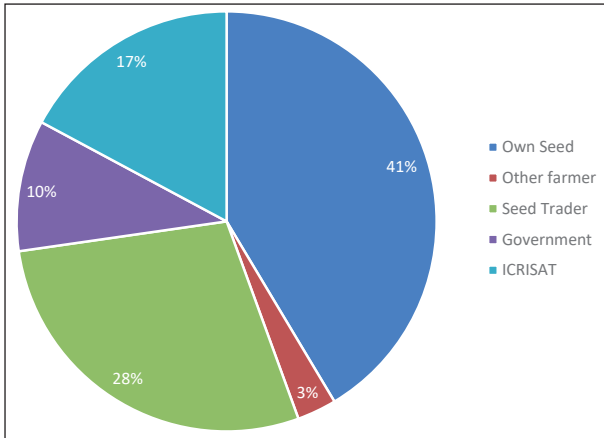


Figure 11. Different sources of groundnut seed for farming in Odisha state during Kharif 2016-17.

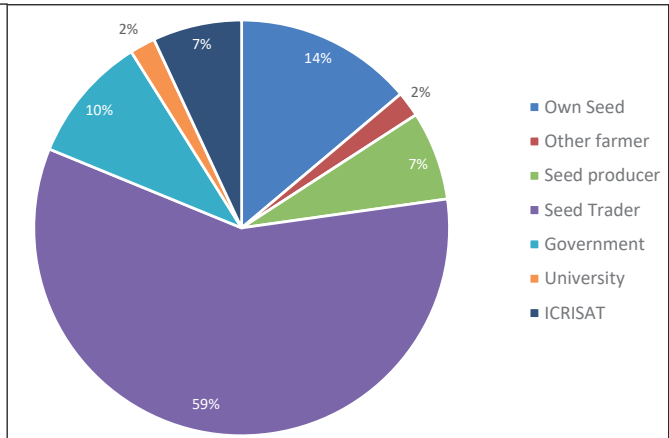


Figure 12. Different sources of groundnut seed for farming in Odisha state during Rabi 2016-17.

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ICRISAT works in agricultural research for development across the drylands of Africa and Asia, making farming profitable for smallholder farmers while reducing malnutrition and environmental degradation.

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