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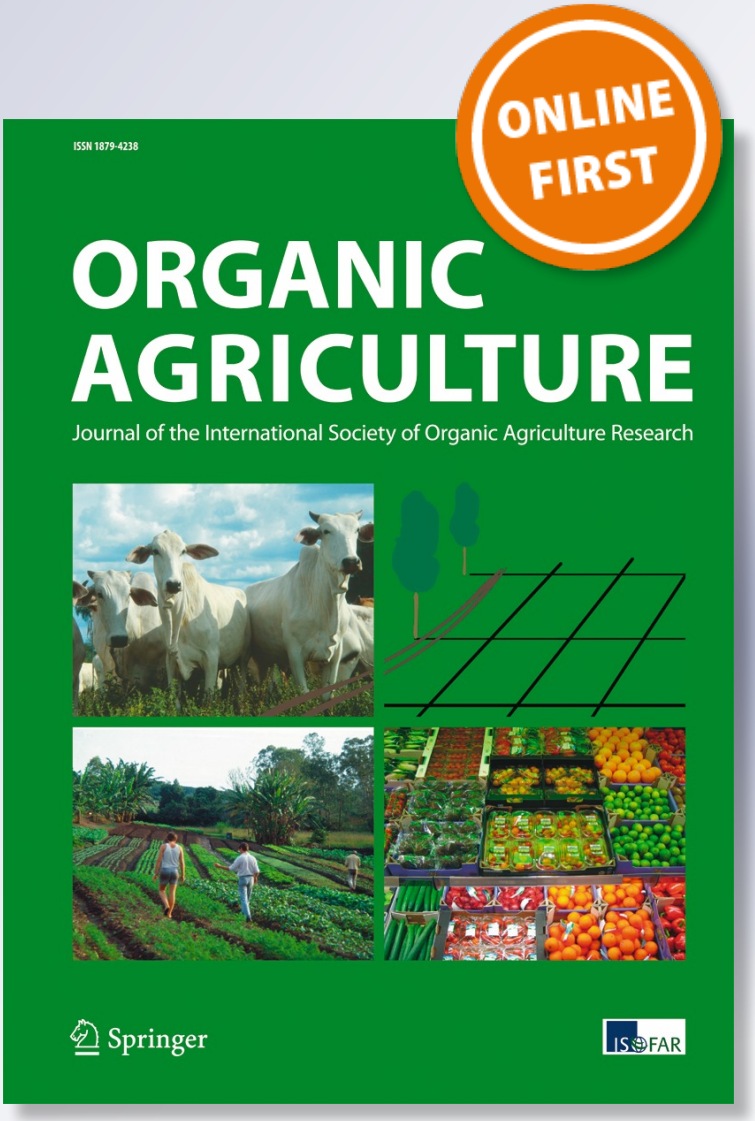

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Production duality, profitability, driving forces and constraints in organic peanut cultivation in India

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Abstract Production duality in peanut cultivation is referred as conventional and organic method. A field survey was conducted in Gujarat state, India, to assess the cost and benefits of production duality in peanut; different organic formulations practised; and motivational factors and constraints in organic peanut cultivation. Thirty organic peanut growing and equal number of conventional farmers were selected through multistage sampling procedure, and face to face interview was conducted using pretested interview schedule. The results revealed that farmers were practising different organic formulations and their cost varied depending upon the inputs used. There were no significant differences in age, education and experience in farming between the organic and conventional farmers, but considerable differences were observed in the number of effective workers and livestock owned. It implies farm households with more family members and livestock are practising organic peanut cultivation. The total cost of cultivation in organic peanut was $699/ha, whereas it was $656/ha under conventional method. The total return in organic peanut was $1233/ha, whereas it was $1192/ha under conventional methods. The net returns realized by organic peanut growing farmers was $534/ha, whereas it was $536/ha by the conventional peanut farmers. There is no significant difference in the net return per hectare between organic and conventional methods, if organic and other inputs supplied from farmers own sources are imputed. However, if other sustainable benefits to the environment, ecology, landscape, consumers, etc. are included in valuation, the returns may outweigh in organic method. Besides traditional organic inputs like Farm Yard Manure (FYM) and compost, farmers used their own organic formulations like *Panchamrut* or *Panchagavya*, *Jivamrut* and *Dharamrut* and cost of these formulations ranged from $7.2/ha to $41.3/ha. The major factors that induced shift to organic peanut farming were soil improvement, awareness on hazards of conventional method and to reduce dependency on external inputs like chemical fertilizers and pesticides. The private institutions and individuals rather than the public institutions were the major motivational source for organic peanut cultivation, indicating the necessity of involvement of public institutions at different levels from farm to consumer for ordered growth of peanut cultivation. The initial decline in crop yield, high price of organic inputs supplied by the private companies and non-realization of premium price by farmers were the major constraints in organic peanut cultivation. These constraints have to be addressed by farmers themselves as well as by the government through appropriate policy intervention to upscale organic peanut cultivation in India.

Keywords Organic peanut cultivation · Organic formulations · Economic analysis · Motivational factors · Garret ranking

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Introduction

Peanut (*Arachis hypogaea* L.) is an important leguminous oilseed crop grown in India. It is grown in 5.2

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million hectares in semi-arid regions. The major states in which peanut is grown are Gujarat, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu and Rajasthan. The average productivity of peanut in India was 1317 kg ha^{-1} (2013–2014) which is far lower compared to countries like USA (3795 kg ha^{-1}), China (3500 kg ha^{-1}) and Myanmar (1578 kg ha^{-1}) (Singh 2014). Organic cultivation has attracted increased attention over the last one decade as they are perceived to offer some solutions to the problems that limit the agriculture sector (Charyulu and Dwivedi 2010). Besides this, world over the premium price for the organic product induced many farmers to adopt organic method. Organic cultivation provides benefits like environmental protection, conservation of non-renewable resources and improvement on food quality (Worthington 2001; Sheetal et al. 2014). It also improves the physical properties of the soil, supplies major and micro-nutrients to the crops, uses local materials and thus becomes eco-friendly and sustainable in the long run. In developed countries, organic cultivation is driven by health conscious consumers backed by higher purchasing power. However, in a developing country like India, the factors that influence the organic cultivation of crops are different due to inherent problems in production, marketing, imperfection in markets, institutional failures, lack of awareness, etc. Despite the problems, India has vast potential in organic crop cultivation due to its wide agro-climatic conditions (Salvador and Jyoti 2003). In several parts of the country, it is an inherent tradition of growing crops using organic materials (Mahale 2002). The Government of India also initiated National Programme for Organic Production (NPOP) during 2000 and National Project on Organic Farming (NPOF) in 2004 for promoting organic farming in the country. Several non-governmental organizations (NGOs) and farmer groups also play an important role in production and marketing of organically produced commodities. In India, some organic farms are certified and some are not yet certified, though they meet the standards and regulations, and these non-certified farms may be called as 'organic by default'. Currently, India ranks tenth in terms of total land under organic certification with 5.21 million hectares (2012–2013). India produced around 1.34 million MT of certified products (http://www.apeda.gov.in). India exported 135 products with the total volume of 165,262 MT (2012–2013). The organic agri-export realization was around USD 374 million. Organic products are mainly exported to EU, USA, Switzerland, Canada, Southeast Asian countries and South Africa (APEDA 2014). Oilseed crops take the lead among the total products exported to different countries.

In India, traditionally, peanut was cultivated under organic (natural), rain-dependent and low-input conditions. But after the 1960s, slowly, use of inorganic chemicals was part of peanut cultivation, especially in the form of fertilizers, insecticides, fungicides, weedicides, etc. Of late, some farmers are shifting to organic peanut cultivation mainly due to escalation in fertilizer and pesticide cost and also to some extent due to awareness about harmful effects of chemicals used in crop production. This resulted in dual production methods (organic and conventional) in peanut cultivation. In literature, there is very little information available on the cost and benefit of production duality in peanut crop, reasons for shift, motivational factors for change in production methods, etc. Hence, in this paper, an attempt has been made to evaluate the economics of duality in peanut cultivation, to compile the different practices followed by organic peanut farmers and to identify the driving forces (motivational factors) and constraints in organic peanut cultivation.

Materials and methods

Multistage sampling procedure was followed for collecting the organic and conventional peanut cultivation data. In the first stage, the important peanut growing Gujarat state was selected. In this state, peanut is grown in 1.63 million hectares with the average productivity of 1612 kg ha^{-1} (Singh 2014). In Gujarat, five districts, viz., Junagadh, Rajkot, Jamnagar, Bhavnagar and Amreli in Saurashtra region are called 'peanut bowl' of India (Reddy 1988). Among these districts, Govindaraj (2012) reported that Junagadh occupies 22 % area (0.4 million ha) and 33 % of peanut production (0.7 million tonnes), and hence, this district was selected in the second stage. In the third stage, three taluks in Junagadh district, viz., Mendrada, Maliya hatina and Keshod were selected randomly. In the final stage, a snowball technique was adopted to identify the organic peanut growing farmers since there was no database available on the number of organic peanut farmers in the selected taluks. Accordingly, upon agreement to take part in the survey, 30 organic peanut growing farmers and equal number of conventional

farmers in 13 villages (Datrana, Bardiva, Babartirth, Samdiyada, Najapur, Rajeshar, Gunadagir, Simachi, Anivada, Moti kodivar, Pikhor, Titodi and Pimpri) were surveyed during the year 2010–2011 with the pretested interview schedule. Majority of the organic farms surveyed are 'organic by default' since they were not certified farms, though they meet the standards and regulations. Economic indicators like cost of cultivation (CoC), gross return (GR), net return (NR) and cost of production (CP) were calculated for organic and conventional peanut cultivation are as follows;

i) GR=PY*PP+HY*HP;
where PY is pod yield (t/ha), PP is pod price ($/t), HY is haulm yield (t/ha) and HP is haulm price ($/t).
ii) NR=GR−CoC
iii) CP=CoC/PY

Descriptive statistics was used to identify the motivational factors and sources, and Garret ranking technique (GRT) was employed to prioritize the constraints faced by organic peanut growing farmers. In GRT, the units were asked to rank the factors that were limiting all aspects of organic peanut production. These orders of merit (ranks) were transformed into units of scores as follows:

$$\text{Percent position} = \frac{100\left(R_{ij}-0.50\right)}{N_j}$$

where

R_{ij} Rank given for ith factor by jth organic farmer
N_j Number of factors ranked by jth organic farmer

The percent position of each rank was converted to scores by referring to tables given by Garret and Woodworth (1969). Then for each factor, the scores of individual respondents were summed up and divided by the total number of respondents for whom the scores were added. The mean scores for all the factors were arranged in descending order, and the most influencing factors were identified through the ranks assigned.

Results

Socio-economic profile of the sample farmers

The results revealed that there were no significant differences in age, education level and experience in farming between the organic and conventional farmers. Considerable differences were observed in the number of effective workers in the family and the level of livestock animals owned by the farmers (Table 1). The number of effective workers per hectare was 1.1 among the organic farmers, whereas it was 0.7 in conventional farms, implying that the number of effective workers positively correlates with the organic farming. Similarly, the average number of livestock per hectare owned by the organic farmers (2.0) was more than the conventional farmers (0.8).

Farm size, yield and price realization by sample farmers

The average size of the organic farms was 3.3 ha, whereas it was 3.8 ha in the conventional farms indicating small farm holders are practising organic farming (Table 2). The results also revealed that among the sample farmers, as experience with organic farming increased, the farm area under organic method of cultivation to the total farmland also increased. The average yield in 3-year-old organic peanut farm was 1.63 t/ha, which is lower compared to conventional farms (1.92 t/ha), whereas the average yield gradually increased as the number of years under organic peanut farming increased. It shows that in the initial stages of conversion, the organic peanut yield falls, whereas after 5 years, yield outweighs the conventional method of cultivation. Increase in yield in organic method of cultivation after few years of conversion might be due to enhanced plant beneficial microbes build up in the soil and also might be due to experience in management by the farmer. The output price is an important factor that induces the farmers to adopt certain method of production. However, in the study area, the average price realized by the organic farmers was marginally higher (6.6 %) compared to conventional farmers (Table 2).

Organic formulations used by the farmers in peanut crop

The indigenous people in a given community have developed various formulations to control pests and diseases and to supplement nutrients to crop growth (Grolink 2005). In the study area, various organic formulations are adopted by farmers in organic peanut cultivation. These organic formulations were used mainly to supplement nutrients, to enhance the beneficial microbial activity in the soil and to control insect, other pests and diseases. Besides traditional organic inputs

Table 1 Socio-economic profile of organic and conventional peanut growing farmers

Variables	Organic	Conventional	Significance levels[a]
Age (years)	48 (35–62)	43 (29–55)	NS
Education (score)	9.5 (0–17)	9.0 (0–15)	NS
Experience in farming (years)	22 (8–35)	19 (5–45)	NS
Experience in organic farming (years)	5.0 (1–15)	–	NS
Household size (score)	5.5 (2–12)	4.2 (3–7)	NS
Number of effective workers/ha (score)	1.1 (0.3–1.5)	0.7 (0.3–1.1)	NS
Livestock/ha (score)	2.0 (0.6–4.2)	0.8 (0.3–1.9)	NS

Figures in parentheses represent range

NS non significant

[a] Independent *t* test results

like Farm Yard Manure (FYM) and compost, farmers used their own organic formulations like *Panchamrut* or *Panchagavya* (Kumawat et al. 2013), *Jivamrut, Dharamrut* and other organic products promoted by public (Anand Agricultural University (AAU) formulation) and private institutions (components of different formulations are provided in Tables 3 and 4). The cost of cultivation varied in organic peanut cultivation on the basis of type of organic formulations adopted by the farmer. The cost of AAU formulation (to enhance the beneficial microbial activity in the soil) was $41.3/ha, whereas the cost of formulations prepared by the farmers like *panchamrut* or *panchagavya*, *Jivamrut* and *Dharamrut* (details in Table 3) was $19.0/ha, $7.2/ha and $10.6/ha, respectively.

Cost and returns of organic vis-a-vis conventional peanut cultivation

The cost of cultivation in organic and conventional method is presented in Table 5. The results revealed that the land preparation cost per hectare was comparatively less (by 4 %) in organic peanut cultivation compared to conventional method and it was mainly due to less number of average bullock hours required for ploughing in organic farms. The average seed cost incurred per hectare was 9 % less under organic method of cultivation since majority of organic farmers used less seed rate per hectare compared to conventional farmer. The less seed rate use by organic farmers was due to bold size of the kernels produced under organic method (Table 4). The fertilizer cost in organic farming was 52 % higher than conventional farms since majority of the farmers used high levels of FYM and farm compost besides the farmers' own formulations (*Panchamrut* or *Panchagavya*, *Jivamrut*, *Dharamrut*). The weeding and inter-cultural operation cost in organic peanut production was 36 % higher than the conventional method of cultivation. The plant protection cost was significantly less by 62 in organic cultivation when compared to chemical control methods used in conventional cultivation. The total cost of cultivation in organic peanut was

Table 2 Farm size, yield and price realized by organic and conventional farmers

Variables	Organic				Conventional
	<3 years	3–5 years	>5 years	Mean	
Average size of the farm (ha)	4.1	2.9	2.9	3.3	3.8
Average organic farm area (ha)	1.7	2.1	2.2	2.0	–
Organic farm area to total land (%)	41	72	76	62	–
Yield (t/ha)	1.63	1.74	2.18	1.85	1.92
Price range/average price ($/t)	525–655			578	542

Source: farm survey

Table 3 Composition of organic formulations used in peanut cultivation and their cost

Bio-products	Rate ($)
Bioforce (plant growth stimulant)	7.0/L
Biopower (soil enricher)	9.0/L
Biosanjivani (enriched neem cake)	5.7/kg
Trident (plant growth regulator)	5.0/L
Amrut (plant growth regulator-cytokinin)	40.0/L
Amrut guard (neem pesticide)	30.0/L
Allout (bio-pesticides)	42.0/L
Biogold (bio-fertilizer mixture)	6.0/kg
Powergold (granular soil conditioners)	8.0/kg

Source: farm survey

$699/ha, whereas it was $656/ha under conventional method. The major cost incurred was on fertilizers both in the organic and conventional peanut cultivation. The total return in organic peanut was $1233/ha, whereas it was $1192/ha under conventional methods. The higher gross return in organic method was due to marginal increment in price (6.6 %) of nuts in-shell over the conventionally produced peanut. The average price realized by the organic farmer was $578/t, whereas it was $542/t by the conventional farmer. There is no considerable difference in the pod yield levels per se, whereas significant difference in haulm yield was observed under organic method. The net returns realized by organic peanut growing farmers was $534/ha, whereas it was $536/ha by the conventional peanut farmers. Hence, we can conclude that there was no significant difference in yield (pod), profit levels and cost of production in organic and conventional methods, when the costs of own farm materials (FYM, farm compost, etc.) including family labour and commercial formulations used by the farmers were imputed. However, if the price of commercial organic formulations is regulated, the investment might be reduced and that might lead to increase in profit in organic peanut cultivation. Moreover, if environment and ecological benefits are considered in valuation, the cost of organic peanut cultivation might be significantly superior over conventional method.

Motivational sources of organic peanut cultivation

The motivational sources for organic peanut cultivation in the study area are presented in Table 6. The results revealed that around 37 % of the sample farmers opined that the agro-service centre located in the Menderada (nearby town) was responsible for adopting organic peanut cultivation method. The relatives and non-governmental organizations (NGOs) were also a profound source for 27 and 20 % of the sample farmers, respectively. It implies that private institutions and individuals were the major motivational sources for organic peanut production.

Motivational factors for adopting organic peanut cultivation methods by the farmers

The results of motivational factors revealed that 93 % of the sample farmers shifted to organic peanut cultivation since it improved the soil quality and fertility and 87 % of farmers shifted due to hazardous nature of inorganic

Table 4 Commercial bio-products used in peanut cultivation and their cost

AAU		*Panchamrut*		*Jivamrut*		*Dharamrut*	
Composition	Qty./ha	Composition	Qty./ha	Composition	Qty./ha	Composition	Qty./ha
Jaggary (kg)	24	Cow urine (L)	12	Cow dung (kg)	24	Cow dung (kg)	24
Cow urine (L)	24	Cow dung (kg)	24	Cow urine (L)	20	Cow urine (L)	24
Cow milk (L)	24	Cow ghee (kg)	1.2	Pulse flour(kg)	2.5	Pulse flour (kg)	5
Vanvruddhi (kg)	1	Cow milk (L)	12	Grain flour (kg)	2.5	Jaggary (kg)	5
Water (L)	480	Honey (kg)	1.2	Jaggary (kg)	2.5		
		Water (L)	480	Water (L)	480		
				Soil (kg)	2.5		
Total cost ($/ha)	41.3	19.0		7.2		10.6	

Source: farm survey

Table 5 Average cost of cultivation of organic vis-a-vis conventional peanut cultivation

	OP	CP	CP=100
Land preparation ($/ha)	37.0 (12.5–50.0)	38.6 (30.5–62.5)	96
Seed ($/ha)	91.2 (82.0–92.4)	100.2 (90.5–113.5)	91
Seed treatment and sowing ($/ha)	29.0 (12.5–75.1)	27.7 (25.0–36.0)	104
Fertilizer (chemical and organic) including application ($/ha)	194.4 (175.1–205.0)	127.8 (97.1–193.7)	152
Weeding and inter-cultural practices ($/ha)	112.0 (77.1–136.0)	81.8 (52.0–109.8)	136
Plant protection ($/ha)	9.2 (4.6–15.0)	24.4 (14.9–65.0)	38
Harvesting and threshing ($/ha)	116.3 (95.1–125.8)	118.4 (97.2–134.5)	98
Rental value of land and land revenue ($/ha)	108.2 (90.0–110.0)	108.2 (90.0–110.0)	100
Miscellaneous expenditure ($/ha)	2.5 (0.0–4.7)	29.0 (15.6–55.8)	09
Total cost of cultivation ($/ha)	699.2 (549.0–813.8)	656.1 (512.8–880.8)	107
Pod yield (t/ha)	1.85 (1.27–1.94)	1.92 (1.58–2.05)	96
Mean pod price ($/t)	578 (510–600)	542 (440–590)	106
Haulm yield (t/ha)	2.57 (2.35–2.85)	2.35 (2.25–2.40)	110
Mean haulm price ($/t)	64 (56–68)	64 (56–68)	100
Total returns ($/ha)	1233.3 (779.3–1357.8)	1191.9 (821.2–1372.7)	104
Net returns ($/ha)	534.1 (230.3–543.9)	535.8 (308.4–491.9)	99
Average cost of production ($/kg)	0.4	0.3	

Figures in parentheses indicate range values

OP organic production, *CP* conventional production method

method of production. Around 67 % of the farmers shifted to organic farming mainly to reduce dependency on external inputs and thereby to increase their profits, and only 10 % of the farmers were induced by higher price of inorganic inputs (Table 7). From the results of motivational factors, it can be concluded that the major factors that induced shift to organic farming were soil improvement, awareness about hazards of conventional method and to depend less on external inputs.

Table 6 Motivational sources of organic peanut cultivation

Source	Number of farmers	Proportion (%)
Relatives	8	26.7
Fellow farmers	2	6.7
Agricultural University	–	–
Department of Agriculture	–	–
NGOs	6	20.0
Agro-service centres (organic products)	11	36.7
Self-interest	3	10.0

Source: farm survey

Major constraints ranked by organic peanut farmers

The results of constraints ranking by the organic peanut growers are presented in Table 8. The ten constraints were ranked by the sample farmers based on their perception. The highest rank was provided to the major constraint and then the rank descends thereafter. The Garret score for the constraints ranged from 27 to 68. The results revealed that initial decline in crop yield was

Table 7 Motivational factors for adoption of organic peanut cultivation methods

Factors	Number of farmers	Proportion (%)
High price of inorganic inputs	3	10.0
Timely non-availability of inorganic inputs	4	13.3
Hazards of inorganic method of production	26	86.7
To reduce dependency on external inputs	20	66.7
Improvement in soil quality and fertility	28	93.3

Source: farm survey

Table 8 Constraints in organic peanut cultivation

Limiting factors	Score	Rank
Non-availability of organic inputs in sufficient quantity at farm	42	VII
Inferior quality of organic inputs available in the market	39	VIII
High price of organic inputs supplied by private companies	67	II
Initial decline in crop yield	68	I
Non-realization of premium price by farmers	62	III
Lack of readymade market	50	VI
Labour intensive	61	IV
Inadequate access to technical know-how	27	X
Lack of government support to promote organic farming	56	V
Neighbouring inorganic farm harbours pest and diseases affecting organic farmers' crop regularly	28	IX

Source: farm survey

considered as major constraints (rank I), followed by high price of organic inputs supplied by the private companies (rank II) and non-realization of premium price by the farmers. The other constraints in the descending order are labour intensiveness, lack of government support, lack of readymade market, non-availability of organic inputs in sufficient quantity at farm, inferior quality of organic inputs available in the market, neighbouring inorganic farms harbor pest and diseases and inadequate access to organic technical know-how to reduce the cost of cultivation. The majority of the organic peanut growers perceived the initial decline in yield after switching from conventional to organic cultivation method as a major problem. The decline in yield might be due to less availability of nutrients supplied in organic method besides other complex issues that limit the yield. However, farmers opined that as season progresses and organic inputs are continuously supplied, the yield increases progressively and even outweighs after 3 to 5 years depending on different farm soil status. Hence, it can be concluded that decline in yield might be a short-term factor and may not affect in the long run. The second major problem perceived by the farmers was high price of organic inputs supplied by the private companies. Hence, it warrants urgent policy to regulate the price of different organic inputs supplied by the private companies. Besides price regulation, an institutional mechanism has to be created for checking the quality of the organic inputs. Though the Government of India initiated programmes like National Programme for Organic Production (NPOP) during 2000 and National Project on Organic Farming (NPOF) in 2004 for promoting organic farming in the country, a separate regulation is necessary to regulate quality of the inputs and prices charged by the private companies. It will ensure availability of quality inputs, reduce cost, increase profit and ensure promotion and up-scaling of organic peanut cultivation in the long run. The third major constraint was non-realization of premium price by the farmers. In developed countries, the premium price for organic produce ensures the spread of organic cultivation area, whereas in developing countries like India, the organic cultivation is switching to traditional methods due to several factors like high cost of inorganic inputs and declining profits and certainly not price induced. Moreover, due to inherent problems like imperfection in markets and marketing and institutional failures in India, the premium price is not realized by the organic peanut grower. The other minor problems that limit organic peanut cultivation perceived by the farmers have to be addressed by the farmers themselves (local level) as well as by the government (policy level) to increase area under organic peanut cultivation.

Discussion

In organic peanut farms, considerable difference in number of effective workers was observed compared to conventional farms. It could be inferred that more family member households are practising organic peanut cultivation since organic farming is a labour-intensive production system. It also implies increased employment levels for the farm workers (Kshirsagar 2007). The small farms are practising organic peanut farming, and it might be due to sufficiency of farm labour requirement for the day to day operations, availability of sufficient quantity of FYM and other organic inputs required, easy in management of farm, and timely operations. As the experience with organic farming increased, the farm area under organic method of cultivation to the total farmland of the farmer increased. It might be due to realization of benefits like less water requirement, withstanding drought conditions and large pod size in organic methods (Maheswari and Haripriya 2008; Nileema and Sreenivasa 2011). The average yield in 3-year-old organic peanut farms was lower compared

to conventional farms, whereas the average yields moved upward as number of years under organic peanut farming increased. It shows that in the initial stage of conversion, the organic yield falls (Ramesh et al. 2005; Prasad 2005; Medina and Iglesis 2008; Tzouramani et al. 2008; Kumawat et al. 2013; Shetty et al. 2014), whereas after 5 years, the yield outweighs the conventional method of cultivation.

The land preparation cost was comparatively less in organic peanut cultivation compared to conventional method, and it was mainly due to improved soil structure in organic farms. The fertilizer cost in organic farming was high since majority of the farmers use high levels of FYM and farm compost besides the farmers' own formulations (*Panchamrut* or *Panchagavya*, *Jivamrut*, *Dharamrut*). This finding is contrary to the traditional notion that the fertilization cost in organic farming is less. The high fertilizer cost in organic peanut cultivation was mainly due to imputation of all the self-possessed organic inputs used by the farmer and due to high price of the commercial organic supplements available in the market. The weeding and inter-culture costs in organic peanut production were higher than the conventional method since the labour requirement is higher in organic than conventional farms (Lampkin 1994; Nieberg and Schulze 1996; Bennett et al. 1999; Smith et al. 2004). The plant protection cost was significantly less in organic cultivation when compared to conventional cultivation, and it was due to use of farm-based inputs like *Panchamrut*, *Jivamrut*, *Dharamrut*, diluted cow urine, etc. for controlling pests and diseases. The miscellaneous cost in conventional cultivation was high since the farmers transport inorganic fertilizer (urea, phosphorous, potash, etc.) from distant places, whereas they are not used in organic method. The average price realized by the organic farmer was higher ($578/t) than the conventional farmer ($542/t) (Ramesh et al. 2010). But majority of organic farmers opined that the higher price for organic produce was due to bold size of pods and kernels and not for the organic method of production or built-in quality of the produce. Hence, appropriate mechanism is necessary to ensure 'premium price' for the organically produced peanut and thus motivate more farmers to join in the organic bandwagon. The net returns realized by organic peanut growing farmers was lower ($534/ha) compared to conventional peanut cultivation ($536/ha), and the same was observed in the first year cycle of cotton-soybean-wheat crop rotation by Froster et al. (2013). The major motivational source for organic peanut cultivation was private institutions and individuals rather than the public institutions. Therefore, it can be concluded that besides private individuals and institutions, public institutions should also be actively involved in promoting organic peanut cultivation in the study area. The important factors that induced farmers to shift to organic farming was awareness about hazards of conventional method and less dependency on external inputs. The major constraints perceived by the farmers are initial decline in crop yield (rank I), followed by high price of organic inputs supplied by the private companies (rank II) and non-realization of premium price by farmers. Hence, the constraints that limit organic peanut cultivation have to be addressed by the farmers themselves (local level) as well as by the government (policy level) to increase area under organic peanut cultivation.

Conclusion

Farmers are adopting various organic formulations in peanut cultivation, viz., own formulations (*Panchamrut* or *Panchagavya*, *Jivamrut*, *Dharamrut)* and other commercial formulations supplied by public and private institutions. The prices of commercial formulations available in the market are higher resulting in high cost of cultivation implying urgent policy intervention to 'control the prices' of commercial organic products besides overseeing the 'quality' and round the year 'availability'. There is no significant difference in the net returns per hectare in peanut cultivation between organic and conventional methods, if organic and other inputs supplied from farmers own sources are imputed, but if other sustainable indicators like benefits to environment, ecology, landscape, consumers, etc. are included in valuation, the returns will be high. It implies if intangible benefits are included in valuation, profits are higher in organic methods, indicating a strong case for promoting large-scale organic peanut cultivation. The private institutions and individuals were the major driving forces for organic peanut cultivation rather than the public institutions and policies, and hence, the involvement of these institutions at different levels from farm to consumer is necessary to promote organic peanut cultivation in a big way. The policies advocated in this study apply to many peanut growing countries in Southeast Asia and Africa with similar peanut production structure, environment and economy. The initial decline in

crop yield, high price of organic inputs supplied by the private companies and non-realization of premium price by the farmers were the major constraints. Hence, appropriate policy that addresses the constraints is the need of the hour for ordered development of organic peanut cultivation in India.

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