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Demand estimation model for Sustainable Profitability of Organic farm produce- A Case Study

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Abstract

With the increase in health consciousness, people across the globe started turning towards organic food. Organic food is a holistic approach which starts at the farm and ends at the fork of the consumers. Organic farming has led abundant opportunities for the farmers and producers but yet there are economic challenges in cultivating and marketing their produce. There is a pull from conventional farming towards organic farming due to environmental sustainable issues, climate change, soil fertility, bio diversity and health benefits to the consumers. Organic farming is treated more like a hobby and often does not involve proper crop planning or accounting practices. This has resulted in low return on investment. These challenges faced by the farmers can be overcome with various strategy, precise planning and support by the government.

It has been noted that a major issue in organic farming is related to downstream supply chain material flow, and demand estimation in particular. This lack of adequate demand estimation has led to surpluses and shortages in the produce which has led to lot of losses across the supply chain. But a few rare players in this field seem to have cracked the issue of managing material information and money flows in this supply chain.

Various related hypotheses are proposed related to problems of marketing the products, identifying the target customers, estimating the demand for the product, proper training for saving and reusing the seeds, profitability as market prices changes in crop and lack of sustained mentoring and support for organic farming from end to end.

Key words: *Organic farming, material flow; information flow; downstream supply chain; demand estimation; Supply chain flow*

Introduction

Agriculture in India has an extensive background for more than 4000 years and organic farming is not new to India as it was used from the Vedic period. Farmers had acquired a high knowledge of the soil fertility, selection of seeds, sowing seasons, and sustainability of crops in diverse lands. (Sofia et.al, 2006). Farmers were sustaining soil fertility for a longer time by doing natural farming relying on organic residues, cow dung, composts, etc (Chandra & Chauhan, 2004). According to International Foundation for Organic Agriculture Movements (IFOAM) "Organic agriculture is a production system that sustains the health of soils, ecosystems and people". Organic agriculture depends on biological processes, biodiversity and cycles modified to local environments, instead of the utilization of inputs with antagonistic impacts. In organic farming preserving the soil healthy through cover crop, crop rotation and soil modification is vital. Organic farming is unfurling with rising demand in India as well as

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worldwide. COVID pandemic made the world shattered, the interest for healthy and safe food is now indicating an upward pattern and subsequently favoring a win-win situation for farmers, consumers and environment. India positions first in number of organic farmers and ninth in terms of area under organic farming. Health consciousness and concerns for environment urges the Consumers to demand organic food even at a premium price (Yadav et.al, 2013).

From time immemorial agriculture has been treated as a business. Land has always belong to the administrative class, but was taken on lease by the working community to grow crops. The portion of the output was given back to the land owners as lease payment (Heady, 1952). Another portion from the remaining was paid to the government as taxes. It was this output along with dairy output that constituted a major part of the GDP output (Wagh & Dongre, 2016). This has been possible for many centuries only because agriculture has been a profitable business venture. However, in the last few decades we have noticed reduced farmer profitability in spite of better hybrid seeds, more access to fertilizers and pesticides, availability of farm automation equipment (Nemes, 2009). While these technologies have resulted in the virtual whipping out of traditional organic farming methods, has not substantially increased the net income of the farmer from previous generations (Nemes, 2009). However there a still a few farmers who have dared to swim against the modern agricultural practices while still running profitable business (Nemes, 2009). This serves as a pointer to the modern agricultural practices ignoring the business aspects of agriculture while focusing on operational aspects alone. Also a few points to note about the modern hybrid seeds and plants as opposed to traditional varieties, apart from higher yields, is higher water consumption (up to 9 times more), higher nitrogen requirement, greater pest damage. All this has complicated the management practice in agriculture while totally neglecting the profitability as mentioned by Das et al (2018).

Alternative agricultural Supply Chain

Agricultural supply chain entails a smooth flow from farm level to consumers to meet consumer's requirements in terms of quality and price. This process involves dealings with businesses responsible for efficient production and supply of produce between firms. (National Institute of Agricultural Extension Management). Generally, involves from manufactures to farmers, farmers to intermediaries and from intermediaries to customers (Roekel et al., 2002). Basically, there are three segments in agricultural supply chain which includes upstream where it comprises of machinery manufacture, fertilizer and pesticides manufacture, hybrid seed supplier and electricity and fuel provider (Pretty et.al., 2000). Intermediaries form the Midstream segment and customers fall under downstream segment (Burch and Lawrence, 2005; Ottesen 2006). While all this development across the supply chain has resulted in lot of economic activity, it has reduced the contribution of farm output to less than 20% of the GDP. In addition it has also reduced the sustained profitability of the farmers who are barely able to make their livelihoods as discussed by Singh R K et al., (2020). This paradox is more troublesome because over 55% of the Indian labour force still depends upon on agriculture and related vocations (Kundu and Das, 2019). This points to a need to restructure the agricultural supply chain for increasing profitability if possible. (Priya and Vivek, 2016))

This study focuses on downstream segment to identify the demand pattern and profitability for the farmers. Supply chain was restructured in downstream segment by adopting the strategies for restructuring flow in chain and restructuring placement of inventory in chain (Shah, 2009). Priya and Vivek (2016) proposed a restructured supply chain where farmers self-sustain and supply products to customers through intermediaries. This model is been adopted by farmers and supply their produce to customers.

Any new commercial model for agricultural practices is best studied by tracing out the activities and principles followed by farmer who is serious about practicing sustainable

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agriculture. Their experience and articulation on the subject serves as valuable pointer to new agricultural theories

Introduction to the farmer

In Coimbatore district, Tamil Nadu, lies 2- Acre Organic farm of Mr Thangavelu, a seventh generation farmer. On this chemical –free patch of land, the 62 year old grows 36 different varieties of organic greens. Earlier he adopted conventional farming method in his 25 cent for cultivating Jasmine flowers using pesticides and chemicals and faced severe loss. With his grandfather and father as conventional farmers, Mr. Thangavelu decided to go organic farming. Mr. Thangavelu did a research on how farming was carried out before 200 years from 1991- 95, by approaching a number of traditional farms and organic schools of thought. With five years of research, he was able to compile a comprehensive set of farming practices and demand management principles to be able to run his agricultural venture as a viable entity. He also cultivates vegetables and coconut apart from greens. However Mr. Thangavelu's organic journey starts midway through his agricultural career. He followed all conventional farming practices and decided to make the switch, only when he saw the struggle to make it a viable business. He also noted the damage his conventional farming practices was causing to the environment and the soil (Fantke et al., 2012). He was guided on an alternate path of agriculture by a few luminaries in this field. The first was Mr.G.Nammalwar who had over three decades of working on organic methods and had an intimate working knowledge of various alternate farming methods. The words of wisdom from this teacher ushered him a new journey for this conventional farmer and he boldly decided to try this alternative. Nammalwar introduced a concept of financially viable organic farm to him. This is supported by research work (Mendoza, 2002). Another luminary Mr.Subash Palekaer also inspired and influenced him with specific principles which was similar to the earlier teacher and were well compiled. These principles included Jeevamurtha, Beejamrutha, Mulching, and Waaphassaa to work on soil rejuvenation, protection and soil fertility (Priya and Vivek, 2016). ZBNF have assisted to increase the yields and returns by holding down their costs significantly and he is self- sustaining through zero budget natural farming.

With Thangavelu's 2 acre are strictly natural farming, his neighbouring farmers were using pesticides and regularly toss chemical fertilizers to their soil. There is no concrete solution to this conundrum except all farmers converting to organic farming and Mr. Thangavelu strongly believes that it will certainly occur within few years. The cost involved for buying pesticides for 1 acre is high for a conventional farming (Praneetvataku et,al 2013, Devi 2010) whereas in organic farming no such cost is involved as natural manure was used. Based on the personal experience he identified the crop mix and market demand for each variety of greens and markets the same directly to the customers and takes the returns within 20 days. His target customers are house wives and in case of excess yield he sells to hotels, sometimes to shop keepers.

Motivation and attitude towards organic Farming

Organic farming is widely practiced across the world and several factors motivates farmers to switch from conventional farming to organic farming (Zagata 2007). Farmers who have concerns for environment and issues related to that are more likely to adapt organic farming (Burton et al., 1999). Getting high yield and returns, soil fertility and soil health are the motives to switch and also has larger shelf life (Krishnan et.al, 2017). Many farmers even while confronting financial challenges, they have retained an attitude and ethic to practice organic farming as a life style than as a business or dare to expand monetary benefits (Sheeder and Lynn,

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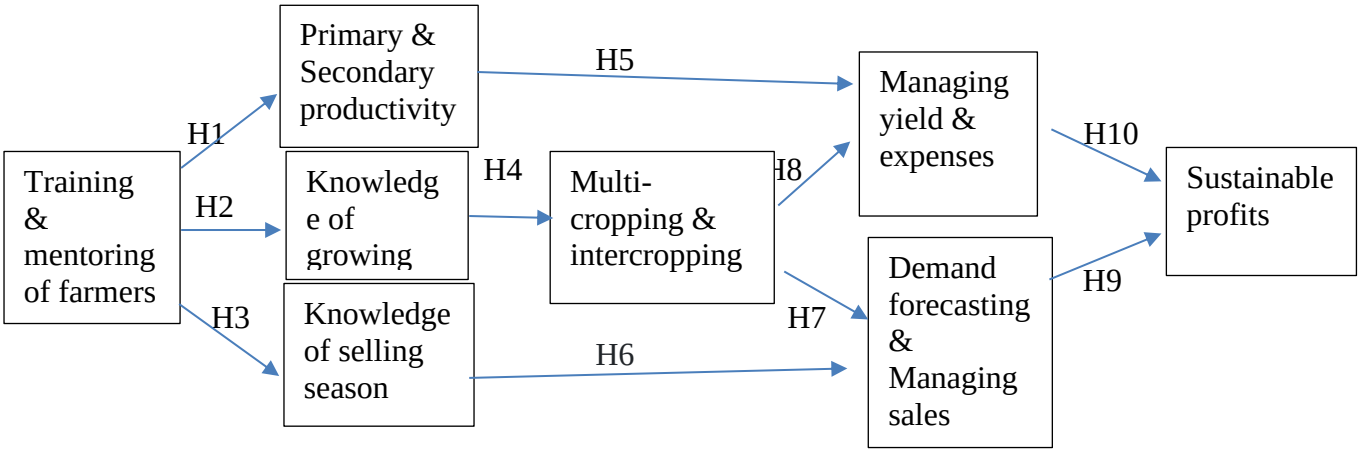
2011). Consumers are health conscious and need for buying health foods made them to buy organic food products. This changing behavior of the consumer has made farmers switch to organic farming (Squires et al., 2001). Consumer's belief and trust towards consuming organic food products are its quality, taste and health benefits (Paul and Rana 2012). Farmers who are educated having a fair knowledge on organic cultivation as they access information from various sources are getting high returns (Ghosh et.al 2019, Shams and Fard 2017, Alzaidi et.al, 2013, Dunlap et.al, 2000, Jayawardana and Shereif, 2010). Farming Experience shows a positive attitude for organic farming (Adebayo & Oladele, 2013, Oluwasusi, 2014, Isin et.al, 2007, Chouichom and Yamao, 2010, Wheeler, 2005). Farmers who have high experience in farming are showing a positive attitude toward organic farming practices. Another important variable that motivates farmers is household size as it reduces the dependence on external labour force without any impact on the production and profits (Sarker et.al, 2009, Adebayo & Oladele, 2013, Oluwasusi, 2014). Wheeler, 2005 and Oluwasusi 2014 found that accessing information through various sources influences organic farming.

Most people consider organic farming as a fancy term due to the lack of standard practices available under organic farming umbrella, has resulted in varying degrees of success for organic farmers (Barik, 2017). Organic farming goes far beyond the making of organic inputs. It is not action of simply replacing chemical inputs with organic prepared ones (Barik, 2017). It is a larger vision and mission that is pursed there. Most farmers trying out organic switch usually give up within one year (Barik, 2017). This is because they are usually confused and are not able to resolve the gaps in the organic farm practice. (Barik, 2017)

The major reasons why people give up organic farming within one year are

1. Low crop yield
2. Not able to achieve the expected quality during the initial years
3. Poor quality of seeds and shortage of bio mass
4. Lack of storage, transport & marketing problems for organic produce
5. Lack of awareness and guidelines for organic farming

Proposed Model for Demand estimation on Profitability of Organic farm produce



Training and mentoring farmers

Many new and existing conventional farmers enter into organic farming but most are not able to succeed due to lack of knowledge in organic farming. Organic farmers can share their experiences, techniques involved and solve issues faced by the new comers. Mentoring

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not only helps in sustaining, but also improves viability, networking and strengthens family owned farms (Mills-Novoa, 2011). In addition to mentoring, they can train farmers, provide resources to gain market access for new and upcoming farmers. Mr. Thangavelu firmly believes that proper training and mentoring to farmers on soil productivity will lead to increased yield. He is of the view that if farmers have knowledge about the growing season and selling season of the greens, it will help them to forecast the demand and manage the sales thereby farmers attain more profits. Government should encourage the farmers by providing proper training and increasing subsidies wherever necessary (Mala and Maly 2013). The hypothesis we propose to sustain organic farming for greens are:

H1: Better training and mentoring of farmers leads to higher primary and secondary productivity of the soil

H2: Better training and mentoring of farmers results in a clearer knowledge of crop growing season

H3: Better training and mentoring of farmers results in better clarity of crop selling season and crop pricing

Transition from Conventional to Organic (Productivity)

The major concern or transition from conventional to organic is nutrient availability in the products. Conventional system will yield high production but deplete natural resources, soil fertility and destroy crop and environment. The biggest changes are in the mindset of the farmers as they want to create a healthy environment and give consumers quality food. Organic farming improves soil health by reducing erosion, increasing soil organic matter, recovering and conserving plant nutrients and promoting good soil structure (Homolka, 2003). Transition process takes more than 2 years to make the soil fertile and farmers face pest control difficulties and lower yield. Pest management techniques are implemented by crop rotation, cover crop, insect traps to enrich soil and increase crop yield (Zinati, 2002). Under Zero Budget Natural Farming growers use inputs like cow dung, cow urine, green chillies, neem pulp, neem leaves available at free of cost. (Priya & Vivek 2016). Another important reason is profitability where they get higher price for organic produce and Personal health factors (Lampkin and Padel, 1994, Thomson, 2000)

The major determinant of crop output is the soil productivity, this involves three soil characteristics 1. Porosity 2. Water retention and 3. Nutrition (Querejeta, 2017). Dabholkar has classified productivity into two categories 1. Primary productivity where the inherent ability of the soil to result in an output is measured 2. Secondary productivity which measures the quantity of external inputs required to sustain the crop productivity. Most of the conventional farming practices have focused on secondary productivity by focusing the entire research initiative on secondary productivity and hardly specify how to improve primary productivity. (Trivedi et al, 2016). Most farmers, conventional and organic have a saying, "During my grandfather's time we use to get record yield of rice with hardly any inputs". This statement is an evidence of the falling primary productivity and increased depends on secondary productivity. (Trivedi et al, 2016) Farmers wants to sustain his soil fertile, productive over a long run. Organic farming helps to build a healthy soil, toxic free environment, gives more yield and hence increase in profit. Encouraging organic farming, (Imtiyaz et.al 2021) has scientifically proved non-judicious use of fertilizers has led to reducing the quality of soil resulting in low productivity and multiple nutrient deficiencies. The reasons for sustaining organic farming are low labour requirement, family involves in farming, long term productivity, Consumers demand for organic food products, market possibilities and high returns. More over to sustain inter cropping, crop rotation and cover crops are been used to enrich the soil and control soil erosion. Water

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contamination is reduced drastically and help conserve water for farm. By using natural pest controlling techniques farmers are able to curtail the expenses.
Based on the above discussion we propose
H5: Better soil productivity results in better crop yield

Growing season and selling season:

Agriculture being a tax-free enterprise in India as resulted in farmers neglecting the practice of maintaining accounts in a systematic and comprehensive manner. Most farmers have only a vague idea of what their farm is generating as net revenue. Mr.Thangavelu is concern with the fact that many of them haven't maintained the accounts for decades.

Table. 1. Expenses and Income statement

Expenses for a year	Amount	Income for a year	Amount
Jeevamurtha 3 times in a year / acre. Rs.1000 per acre	Rs.3,000 Rs.3,600	Every 2 months income from greens per acre Rs.45000x 4 times	Rs.180,000 Rs.56,000
Tractor used for yielding once in 2 months for 8 month yield Rs.1200 per acre	Rs.3,750 Rs.15,000	Vegetables per 5 cent Tomato Green Chilly	Rs.28,800 Rs,115,200
Purchase of seeds 15 Kg @ 250 per kg	Rs.12,000	Brinjal , Lady's Finger, Raddish, Beet root, turnip cabbage , Shallots	
Labour expenses for spraying Jeevamurtha Rs. 500 per labour @10 labour for 3 times Sowing seeds labour expenses 6 labours @500 per labour for 4 times			
Total expenses	Rs.37,350	Total Income	Rs.380,000

Note: Rs denotes Indian Rupee Value
Source: Author's work

Due to lack of proper accounting of the transactions the profitability motive is usually missing among the organic farmers, who are more focused on crop yields and other issues with conventional farming. This lack of focus on revenue and profitability is an important reason for the inability of organic farmers to be profitable on a sustainable basis. Mr.Thangavelu is on record that in his early days of the organic journey he had cultivated spinach, which gives yield within a month of July. In spite of his plants giving record output of around 5 tons per acre, he was unable to sell the produce due to wrong choice of demand season to grow spinach. He had to dump all his produce and he incurred a huge loss in spite of following all the organic farming practices in the book. Similarly through trial and error he was able to identify the demand season for each of the green leaves vegetable that he grows now. This helped him to decide on the pattern of multi cropping of greens and vegetables.

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Table. 2. List of crops with season and sales

List of crops	**Classification**	**Growing season**	**Selling season**	**Price per bundle**
Moringa Oleifera	Tree & Perennial	Throughout the year	Throughout the year	Rs 10-15
Sesbania grandiflora , Vigna unguiculata ssp. Sesquipedalis, Sauropus androgynous, Hisbiscus cannabinus, Justicia adhatoda	Tree & Perennial	Throughout the year	Throughout the year	Rs 10
Centella asiatica, Portulaca quadrifida- red / green Cardiospermum halicacabum, Solanum trilobatum, Phyla nodiflora, Cissus quadrangularis, Mukia maderaspatana, Chenopodium Album, Murraya Koenigii, Marsilea quadrifolia, Aloe Vera, Water spinach	Perennial	Throughout the year	Throughout the year	Rs 10
Alternanthera sessilis- red/ green & country	7 to 8 months	365 Days	365 days	Rs 10
Cichorium intybus Rumex vesicarius	6 months	365 Days	365 days	Rs 10
Amaranthus aritis	6 Months	Except rainy season	Except rainy season	Rs.10
Solanum Nigrum Spinacia oleracea	2 months	Except rainy season	Except rainy season	Rs 10
Mentha Arvensis	2 month season /15 days once yield	Throughout the year	Throughout the year	Rs 10
Amaranthus gangeticus, Amaranthus tricolor, Trigonella foenum-graecum, Coriandrum sativum	1 month	Except rainy season , grown year round	Except rainy season, sold year round	Rs.10
Celosia argentea Digera muricate	1 month	Only rainy season	Only in rainy season	Rs.10
Premna latifolia Portulaca oleracea Amaranthus viridis Amarantus Blitum	1 month	365 days	365 days	Rs.10
Allium ascalonicum	Perennial	July	October , November	Rs.40

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Capsicum annuum	Perennial	Jan-Feb, May to June	Throughout the year	Rs.60
Solanum melongena	3 months	July- Aug	Throughout the year	Rs.40
Abelmoschus esculentus	3 months crop	May- July	Throughout the year	Rs.40
Beta vulgaris Brassica oleracea Raphanus sativus Solanum lycopersicum	Perennial	Throughout the year	Throughout the year	Rs.40

Note: Rs denotes Indian Rupee value
Source: Author's work

Mr. Thangavelu notes that every crop has two kinds of seasons 1. Season to grow 2. Season to sell. Unless both are given attention, farmers will not get a proper sales realization for their crops. They will either under sell their production or will get a very low price for their produce. In either case the farmer gets a reduced revenue realization**.** Hence, we propose the following hypotheses

H4: Better knowledge of growing season enables better planning of multi cropping mix
H6: Better knowledge of selling seasons leads to more accurate demand forecast

Multi-cropping and intercropping

Both conventional and organic farmers were adopting mono cropping system in their fields, later they started using multi cropping and intercropping in the fields. Multi cropping is a process where more than one crop is cultivated simultaneously and gained increased attention among the farmers (Ehrmann and Ritz, 2014). This cropping system gave various benefits to the farmers, increased yield, control to weeds, pests and diseases and efficient utilization of resources and improved soil health (Li .et al, 2003). Right spacing between the crops has resulted in higher productivity and decreasing in spacing resulted in low productivity and its been scientifically proven (Dhillon et.al, 2016). Mr. Thangavelu was able to forecast the demand which helped him to decide the pattern in multi cropping and intercropping of greens and vegetables in his 2-acre farm land resulting in getting more yields. So, based on the above facts we propose the following hypotheses

H7: Clearer Multi cropping and intercropping plans leads to more accurate demand forecast
H8: Clearer Multi cropping and intercropping plans make it easier to achieve better crop yields and keep expense under control

Estimating Demand

Without a proper understanding of demand, it is impossible for farmers to make the right decision about marketing spend, production, labour and so on. Demand prediction will be of great help for the farmers to make financial decisions efficiently as it has direct impact on profits, cash flow, allocation of resources, labour and operational cost. The consumers demand for organic food products are growing enormously as it is chemical free and healthy. The demand for organic greens depends on life cycle of the product, length of the season and lead time of purchase. Life cycle of greens refers its life during off season and season. Some organic greens are sold throughout the year but still experiences peaks and troughs of demand according to the seasons. In case of short seasons, the farmers have to be prepared to deliver the greens as per estimated demand to their customers and for longer seasons, they need to take the yield several times. If lead time is long, decisions regarding sales for greens should be taken well in

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advance. Sales made during the season can be used to forecast demand for a short lead-time, generally during the summer season for certain greens due to the non-availability of customers.

Farmers need to forecast the greens which have demand year long, need to be careful in cropping due to seasonal variations to replenishment, as well as considering the resources when cultivating a variety of greens. In the case of the short season, the entire demand for the greens needs to be forecasted based on the market. The ability to judge the demand varies from one farmer to another. Demand estimation should be made well in advance based on the seasonal sales and also based on customers' requirements. For long-season farmers have to rely on the specific forecast for cultivation and sales of particular greens. This allows the farmers to respond far more effectively to all conditions i.e. Weather, competition. Understanding the dynamics of seasonal greens helps the farmers to determine the demand flawlessly. Forecasting is based on the growing and selling season of different variety of greens. So, based on the above facts we propose the following hypotheses

H9: More accurate demand forecasting results in sustained profitability in organic farming

Maintaining accounts and monitoring Cash flows

Maintaining accounts and records will reveal exact costs incurred, how much returns and profit is generated in business. So, it is utmost important for a farmer to record all transaction, maintain book of account so farming business will be very crystal clear. The profitability of organic farms determined by yield, price and premiums, production costs and payments (Sanders, 2007). This is supplemented by (Younie, 1990; IFAD, 2005; Brumfield et al, 2000; Lyngboek et al., 2001; McBride and Greene, 2008) even with low yield and high production cost farmers are able to reap profits due to market price. With natural manure and fertile soil, production cost was low and resulted in higher profits (Mendoza, 2002; Mahoney et al., 2004). Due to low production cost, taking loans from banks is far less than conventional farming (Eyhorn et al.2005). Family labors are involved in farming (Hanson et al 1997)). So labour cost is omitted while considering the profits. The amount of time spent on farming activities is not considered because it will increase the labour cost. These has to be considered for maintain the records which will facilitate the farmers to identify their cash inflows and outflows. So based on the above facts we propose the following hypotheses

H10: Increased yields and reduced expenses leads to sustained profitability in organic farming

Conclusion

So, to conclude, current organic farming practices also not sustainable for the long term as the focus is more on the production part and not on the demand pattern and pricing factors. We have identified the major problem which is common in both conventional and organic farming practises. i.e. the growth is in one season and the demand is in another season, which they term as Selling season. There is hardly any research and we've identified that as a research gap and converted into a comprehensive model. This is new field and widely open for research. The model can be validated and tested by constructing a questionnaire or by observation method.

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