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Adoption level on Organic Farming Practices by Fluted Pumpkin Vegetable Farmers in Enugu State, Nigeria

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Abstract

The study investigated the adoption of organic farming practices by fluted pumpkin vegetable farmers in Enugu state, Nigeria. Multistage sampling procedure was used to select 84 fluted pumpkin farmers, and data were collected through structured questionnaires that passed through Cronbach's Alpha test. Data collected were analyzed using SPSS software and presented in mean, adoption index, percentages and frequency distributions. Findings indicated that majority (65.5%) of fluted pumpkin farmers regularly acquire information about organic practices through fellow farmers. A higher proportion (70.2%) and (61.9%) of the respondents affirmed that animal manure and farmyard manure practices were some of the organic farming practices disseminated in the zone. The adoption index for all the different organic farming practices examined was 0.516, but animal manure (M=3.94) was highly used. Result also revealed that production/supply constraints, economic/market constraints, institutional/technical constraints and environmental constraints affected adoption of organic farming practices. Furthermore, promoting government policy on organic farming (M=1.58; SD=0.564), increasing extension service deliveries on organic farming (M=1.55; SD=0.589) and establishing organic producing companies to supply adequate inputs (M=1.48; SD=0.564) were the major strategies suggested by farmers that will improve the adoption of organic farming on fluted pumpkin vegetable production. Therefore, government, through the ministry of agriculture should train extension agents and fluted pumpkin vegetable farmers on effective application of organic manures on crops so as to maximize yield. Also, government should bring up policies that would promote production, marketing and consumption of organically produced fluted pumpkin vegetables.

Keywords:
Adoption, Organic, Manure, Information, Crop Production, Fluted Pumpkin

1. Introduction

Soil fertility is the most significant component of every cropping system and is a critical asset for productivity and positive environmental outcome (Etim, 2015). Many cropping systems are threatened by land overuse and agricultural intensification, as soils have been harmed, eroded, and rendered unproductive. There is no doubt that land over-use has subjected the food system to poor yields, resulting in poor welfare, particularly for smallholder farmers in sub-Saharan Africa, whose livelihood is heavily dependent on agriculture. Intensive agricultural production practices have also put a strain on natural resources through increased usage of agrochemicals. This has resulted in significant harm to the soil, coupled with substantial pollution and health risks (Shaban, 2015). Despite efforts to meet the growing population's demand for food, Nigeria's crop production continues to be harmed by the

long-term effects of increased agrochemical use, climate change, soil degradation, low soil fertility, all of which can be addressed by alternative farming practices (Oluseyi *et al*., 2019).

According to Mgbenka et al (2015), organic farming is a comprehensive production management approach that promotes and improves agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. Its main goal is to produce safe, nutritious food while ensuring the long-term viability of the environment. Because of multiple idiosyncratic and covariate risks, small-scale farmers employ various sustainable agricultural strategies to mitigate production risks (Mgbenka et al., 2015). Farm owners have to make logical decisions between different sustainable farming practices and diversified risk-driven multiple cropping systems to know which options to embrace (Oyetunde-Usman et al., 2021). Nonetheless, organic farming remains an excellent way of restoring depleted natural soil nutrients, sustaining good soil conditions, and renewing the health of poor soils for cropping on a long-term basis. Some of these approaches include intercropping, rotation of legumes with cereal crops, integrated pest management, the utilization of animal droppings, and residue retention (Ehiakpor et al., 2021).

Adoption of all these organic farming approaches on vegetable production especially fluted pumpkin is not only necessary, but ideal. Fluted pumpkin vegetable is one of the most consumed vegetables in this zone. The leaves and fruits are eaten fresh or cooked and can be used medicinally. As an important food, growing it under organic system will ensure safety and eliminate harmful residues which the use of synthetic materials could impose. Again, it will improve availability of the vegetable and sustainable production. However, adoption of agricultural practices including organic farming is not without cost, and this may lead to delay in rate of adoption. While many problems may cause delay in adoption, Wollni & Andersson (2014) noted that inadequate information, lack of capital, market failures, and many others affect diffusion and adoption of nature-based farming practices. The delay in adoption rate is not specific to sustainable agriculture systems; it is prevalent in adopting new technology farming sector. Regardless, evidence suggests that farmers who have adopted organic farming have raised their productivity and farm profitability (Nkonya et al., 2015).

The literature search shows that little or no study exist on adoption level of organic farming practices by fluted pumpkin vegetable farmers in Nigeria. Etim and Udoh (2020) analyzed the adoption decision of organic waterleaf farming for sustainable production, using Akwa-Ibom State, Nigeria, as the case study, while Oyetunde-Usman et al. (2021) studied the determinants of the adoption of multiple nature-based agricultural practices among smallholder farmers in Nigeria. Many additional studies have looked at farmer decisions to embrace a portfolio of eco-friendly agricultural techniques with cases outside Nigeria. For example, Kassie et al (2015) focused on a portfolio of sustainable intensification practices in East Africa, using Malawi and Uganda as the case study. Several data approaches, such as standard Poison, zero-inflated Poisson, negative binomial, and gamma, have been used to simulate the intensity of adopting organic farming practices and production technology. Ehiakpor et al (2021), for instance, used a multivariate Probit and a zero-truncated Poisson to identify the determinant of sustainable agricultural practices adoption and adoption intensity, respectively, from a sample of 320 agricultural householders in Ghana.

Also, some studies tend to find out the relationship between farmers socioeconomic characteristics and adoption on organic farming. For Etim and Udoh (2020), farmers' expertise and membership in a farmer-based organization played a role in the adoption of organic farming, as information tends to flow between group members. The study also asserted that formal education was substantially connected with organic farming. Similarly, many economists have documented farmers' adoption and diffusion of agricultural technology in emerging countries, and results indicated that the farming experience has a statistically significant impact on adoption (Rana et al., 2012). Knowledge of the adoption of organic farming practices as an urgent remedy for the health and environmental danger linked with agrochemical use on fluted pumpkin production is necessary. As a result of this premise, the study was designed to investigate the adoption of organic farming practices by fluted pumpkin vegetable farmers in Enugu state, Nigeria. Specifically, the study:

i. ascertained farmers sources of information on organic practices;
ii. identified organic farming practices disseminated to fluted pumpkin farmers;
iii. determined the adoption level of organic practices on fluted pumpkin production;
iv. identified constraints limiting the adoption of organic farming practices on fluted pumpkin production; and
v. identified strategies to improve adoption of organic farming practices by fluted pumpkin farmers

2. Methodology

2.1 Study area

The study was carried out in Enugu state, Nigeria. Enugu state is located between latitudes 5°56 and 7°06 norths of the equator and longitudes 6°53 and 7°55 East of the Greenwich Meridian. It has 3 blocks and few circles. The

zone has a favourable soil for agricultural activities. Thus, most of their inhabitants are either full time or part time farmers. They produce crops like vegetables, yam, cassava, rice, maize, pineapple, banana and palm etc. They are also involved in poultry production and small livestock (sheep and goat) production amongst others.

2.2 Population and Sampling procedure

The population for the study comprised all vegetable farmers in Enugu state who are actively engaged in fluted pumpkin production. Multistage sampling procedure was used in selecting the sample for this study. The first stage involved random selection of two blocks (Nkanu east and Nkanu west) while the second stage involved random selection of three circles from each of the selected blocks, giving a total of 6 circles. The third stage involved random selection of fourteen (14) fluted pumpkin vegetable farmers from each of the circles, making it a total number of eighty-four (84) respondents for the study.

2.3 Method of data collection and measurement of variables

Primary data were used for this study. Data was collected through structured questionnaire complemented with an interview schedule. The instruments gave a score of 0.722 in Cronbach's Alpha test. Information sources on organic farming practices on fluted pumpkin was elicited through yes (1) or no (0) responses from vegetable farmers against various possible information sources. To determine organic farming practices disseminated to the farmers, yes (1) or no (0) responses were elicited from the farmers on different organic farming practices disseminated. The adoption level of organic farming practices by fluted pumpkin farmers was ascertained through the adoption index. To achieve this, respondents were asked to indicate their stages of adoption on each practice on a 5-point Likert-type adoption scale: awareness (1), interest (2), evaluation (3), trial (4), and adoption (5). The adoption index was calculated as thus: (i) Total adoption score per practice was calculated by adding up all adoption scores for the practice (ii) Computation of the total mean (M) adoption score was done by dividing the adoption scores with the number of respondents involved. (iii) Computation of the grand mean (M) adoption score was calculated by adding all the mean adoption scores and dividing by the number of practices considered and (iv) Computation of the adoption index was carried out by dividing the grand mean (M) adoption score by the 5-stages of adoption process.

To determine constraints limiting the adoption of organic practices, a 5-point Likert type scale of very great extent, great extent, moderate extent, little extent and no extent with scores 4, 3, 2, 1 and 0 respectively was used. The scores were summed and divided by 5. Variables which have a mean value of 2.0 and above were considered the constraints while values less than 2.0 were considered otherwise. This data was also subjected to further analysis, and variables with value of 0.4 or higher were regarded as constraints. The constraints were grouped into four major components. Additionally, strategies to improve adoption of organic farming practices in fluted pumpkin production were measured by asking farmers to rate their improved organic farming practices on a 3-point Likert type scale of very important = 2; important = 1 and not important = 0. The scores were added and divided by 3. Variables with mean score greater than or equal to 1.0 were considered strategies to improve organic farming practices while mean scores less than 1.0 were regarded otherwise.

The data collected were analyzed with IBM SPSS software using percentages and frequency, mean score and factor analysis.

3. Results and discussion

3.1 Sources of information on organic farming practices for fluted pumpkin production

Respondents' sources of information on organic practices, as presented in Table 1, revealed that 65.5% of the farmers sought information from fellow farmers and neighbours, while 60.7% sought information from family and friends. This implies that farmers depend on interpersonal channels for information on organic farming practices and this may be due to its relative cost, availability, and accessibility when compared to other information channels. Interpersonal channels are crucial for disseminating agricultural information to farmers because it involves face-face discussion and can facilitate quick feedback. The finding is in line with Yaseen *et al* (2016), who found that sources of information for farming activities among rural farmers were neighbours, friends, and relatives, while very few farmers sourced information from extension agents.

Less than half (40.5%) of the respondents sought information from the internet and television, 39.3% sought information from the radio, while 35.7% of the respondents also sought information from the newspaper. Mass media plays an essential role in creating awareness and interest in certain organic farming practices. For instance, electronic mass media such as radio and television are crucial in creating awareness of organic farming practices among large farmers. However, they do not provide detailed information that will convince the farmers to adopt organic farming practices. Internet and print media such as newspapers, books, journals among others are crucial in explaining technical and complex details of a particular organic method, which is necessary to strengthen farmers' interest in

the practice. Nevertheless, print media are used mainly by literate farmers who can read and write in contrast to illiterate farmers.

In addition, 19% of the respondents' sourced information on organic farming practices from extension agents. This implies that only few farmers sourced information from extension agents. This may result from the attitude of farmers towards extension service. It may be due to lack of extension workers in the zone. Whichever it is, the performance of extension agent in dissemination of information on organic farming practice was not encouraging. This agrees with Olorunfemi *et al* (2020) who found that extension agents had low involvement in the dissemination of use nature-based farm management practices.

Table 1. Sources of information on organic farming practices for fluted pumpkin production

Sources of information	Frequency	Percentage
Extension agent	16	19.0
Radio	33	39.3
Television	34	40.5
Family and friends	51	60.7
Fellow farmers and Neighbour	55	65.5
Internet	34	40.5
Newspaper	30	35.7
Books and journal	22	26.2

Field survey, 2021

3.2 Organic farming practices disseminated among fluted pumpkin farmers

Data on the organic farming practices disseminated to fluted pumpkin farmers, as presented in Table 2, revealed that 70.2% and 61.9% of the respondents affirmed that animal manure and farmyard manure technologies were disseminated for fluted pumpkin production. The benefits derived from organically cultivated fluted pumpkins cannot be overemphasized. Farmyard manure (FYM) is one of the several valuable nature-based fertilizers helpful in maintaining soil fertility in sustainable agriculture systems (Järvan et al., 2017). When used in the right proportion, animal manure and FYM can improve soil fertility, crop production, and socioeconomic returns on investment in the short and long run (de Haan & van Geel, 2018). Fluted pumpkin farmers in the study area use animal manure and FYM to supply nutrients to the soil to enhance their crop productivity, probably due to its availability and relatively low cost compared to inorganic fertilizers.

Less than half (40.5%) of the respondents affirmed that compost manure and cover crops technologies were also disseminated. Composting reduces the total mass, volume, and water content of manure when compared to fresh waste, which in turn reduces the cost of transportation. Additionally, composting helps in minimization of parasites, pathogens, odour emissions, and weed seeds from the manure, thereby making it safer for application in pumpkin production. Cover crops on the other hand, play an important role in maintaining soil chemical, biological and physical properties. They help protect the soil from erosion, suppress weeds, and incorporate more organic matter into the soil. Cover crops improve soil fertility by accumulating a large amount of plant nutrients in the soil and preventing their losses through lixiviation (Büchi et al., 2018). The use of compost manure and cover crops are ideal for pumpkin production because they can supply adequate nutrients and suppress weed growth

Other organic farming practices disseminated include green manuring (29.8%), bio fertilization, biological pest management (21.4%), and vermi-composting (14.3%). These practices are sacrosanct for effective crop production, animal and soil health, and biodiversity development.

Table 2. Organic farming practices disseminated among fluted pumpkin farmers

Organic farming practices	Frequency	Percentage
Cover crop manure	34	40.5
Animal manure	59	70.2
Composting	34	40.5
Vermi-compost	12	14.3
Green manure	25	29.8
Bio fertilizer	18	21.4
Biological pest management	18	21.4
Farm yard manure	52	61.9

Field survey, 2021

3.3 Adoption level of organic farming among fluted pumpkin farmers

Result in **Table 3** indicated that the adoption index of the disseminated technologies was M=0.516. In other words, the percentage rate of adoption was 51.6%. This shows that fluted pumpkin farmers were almost halfway in adoption of organic farming technologies. This also reflect in their grand adoption mean (M=2.58). However, in specific, the use of animal manure (M=3.94) was the only organic farming practice fully adopted by fluted pumpkin vegetable farmers. This could be because of the availability, accessibility, and relative low cost of animal manure in the region. Vitale *et al* (2011) opined that animal manure is a lower cost alternative supply of soil nutrients capable of enhancing soil biophysical characteristics. Animal manure serves as a soil amendment and can be used in protecting water and air quality and also reduces greenhouse gas emissions (Mikesell, 2015). It also found to be as effective as commercial fertilizers for the row crops and forage production (Loria *et al*., 2007).

Organic practices such as farmyard manure (M=2.99) and composting (M=2.92) were in the trial stage of organic farming practices adoption. This implies that pumpkin farmers have learned so much about manure composting and farmyard manure practice; therefore, they are certain of the potential risk and socioeconomic benefits of those practices. Pumpkin farmers may be trying manure composting and farmyard manure practice on a limited scale to garner the practical experience of the procedures before making their final decision on whether to adopt or reject the practices based on their personal experience. Therefore, it is necessary to monitor farmers at this point in order to facilitate the adoption.

Other organic farming practices such as green leaf manure (M=2.37), bio-fertilizers (M=2.19), cover crop manure (M=2.17), biological pest management (M= 2.07), and vermin-composting (M=2.02) were all at the evaluation stage of adoption. This implies that farmers are skeptical about most organic farming practices disseminated in the area. They are uncertain about the risks and long-term benefits of most organic farming practices. Farmers that are convinced at this stage will invariably proceed to other stages, including adoption.

Table 3. Adoption level of organic farming among fluted pumpkin farmers

Organic farming	Adoption score	Mean adoption	Grand mean adoption	Adoption index
Cover crop manure	182	2.17		
Animal manure	331	3.94*		
Composting	245	2.92		
Vermi-composting	170	2.02	2.58	0.516
Green leaf manure	199	2.37		
Bio-fertilizers	184	2.19		
Biological pest management	174	2.07		
Farmyard manure	251	2.99		
Total	1736	20.67		

Field survey, 2021

3.4 Constraints to adoption of organic farm practice by fluted pumpkin vegetable farmers

Table 4 is a Varimax Rotation of the constraints that limit fluted pumpkin farmers from adopting organic farming system. This result was classified into four factors based on variable loading. Production/supply constraints (factor 1) show that there is no adequate production and supply of animal dung/litters, composting materials, bio-fertilizers among others. Variables in this factor include: preparation of organic manure is time consuming (0.835), lack of institution that produce organic inputs (0.599) and lack of organic residues for crop production (0.515). Organic residues seem to be ubiquitous especially those from plant origin. However, while the plant residues are common, animal residues are not easily accessible. This is probably because many farmers are not into animal production. It could also be that those practicing animal production are ignorant of proper management of faeces, litter or dung and so, access to animal manure was difficult in the study area.

The second factor named "economic/market constraints" revealed that farmers lack adequate market for organic produce. It also indicated that most organic farms have low yields compare to farms where inorganic fertilizers are used. Variables that are significant under this factor include: poor local market for organic products (0.734), lack of effective training on organic farming (0.647) and organic manure does not give adequate yield (0.611). One of the fundamental criticisms of organic farming is low yield. This could perhaps be due to insufficient nutrients or wrong application of organic manures to crops. Mgbenka et al (2015) found that organic farming has 20% lower yield than conventional farming systems due to the high level of weed infestation in organic farms. Similarly, market for organic residues and products has been identified as serious constraint. No rational farmer will adopt organic farming if they

have no place to buy or sell organic produce at reasonable amount. Pumpkin farmers would probably adopt a farming approach that maximizes their inputs and discard practices that do not improve their farm yield and income.

Also, institutional/technical constraints (factor 3) revealed that institution promoting organic farming system is weak and farmers lack adequate knowledge on organic farming. Variables that load under this factor include: lack of technical know-how on organic farming (0.653), high cost of organic inputs (0.538), inadequate information on organic farming system (0.470) and little or no policy on organic farming system (0.433). Poor extension services and lack of knowledge of organic farming practices among extension agents in developing countries has resulted in deficient awareness creation and dissemination of organic practices from research institutes to farmers. Lack of awareness and inadequate information on how a particular organic approach operates limits the ability of farmers to make the final decision on whether to adopt or reject a specific organic farming practice. Inconsistent government support policies have limited the spread and adoption of sustainable agricultural innovations, technologies and organic farming practices in developing countries. Additionally, high cost of certification of organic products deters farmers from adopting organic farming practices. This situation makes farmers go for third-party organic certification, which most of them couldn't even afford due to their socioeconomic status.

Furthermore, the fourth factor (Environmental constraints) indicated that organic manures could cause pollution (0.778) and pest infestations (0.690). Adeoye et al (2020) noted that the main constraints in nature-based vegetable farming are pest and disease, inadequate storage facilities, and high cost of inputs. Fluted pumpkin organic vegetable farmers have few options to manage pests and diseases compared to conventional farming techniques. The effective pest management on organic farms are achieved using biological control, cropping techniques, and natural pesticides extracted from animal or plant origin (El-Shafie, 2019). This is sometimes expensive, and needs expertise to avoid crop damage and pollution of environment.

Table 4. Constraints to adoption of organic farm practice by fluted pumpkin vegetable farmers.

Challenges to adoption	Production/ Supply constraints(factor 1)	Economic/ market constraints (factor 2)	Institutional technical constraint (Factor 3)	Environ-mental constraints (Factor 4)
Organic manure does not give adequate yield	-0.211	0.611	0.076	-0.122
Lack of technical know-how on organic farming	0.011	-0.209	0.653	0.052
Inadequate information on organic farming system	-0.049	0.093	0.470	0.037
Lack of access to commercial organic fertilizers	-0.105	0.023	0.448	-0.264
Poor research on organic farming system	0.103	-0.384	-0.214	-0.129
Poor local market for organic products	0.297	0.734	-0.241	-0.150
Organic manures are dirty and unhygienic	0.112	-0.279	-0.275	0.153
Little or no policy on organic farming system	0.379	-0.036	0.433	-0.015
Lack of institution that produce organic residues	0.599	0.215	-0.088	0.036
Preparation of organic manure is time consuming	0.835	-0.099	-0.014	-0.066
Lack of effective training on organic farming	0.139	0.647	-0.004	0.041
Lack of organic residues for crop production	0.515	-0.184	-0.005	0.317
High cost of organic manures/ bio-fertilizers	0.099	0.231	0.538	0.332
No governmental support on organic inputs	0.123	0.119	0.286	-0.388
Difficulty in transportation of organic manures	0.378	0.103	0.348	-0.350
Organic manures cause pollution	-0.016	0.162	0.041	0.778
Organic manures attract pest to crop	0.190	-0.166	0.141	0.690

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization
Field survey, 2021

3.5 Strategies to improve adoption of organic farming

Statistics on the strategies to improve the adoption of organic farming as presented in Table 5 revealed that government support policies on organic farming (M=1.58), increasing extension service deliveries on organic farming (M=1.55), and establishing organic producing companies to supply adequate inputs (M=1.48), were the main strategies put forward by fluted pumpkin farmers for improving adoption of organic farming on fluted pumpkin vegetable production. Good policies have positive impact on agricultural production, processing, marketing and distribution, while a bad policy hinders agricultural development. Manju (2017) noted that substantial financial support by the government through financial inclusion policies at the state as well as at the local level is necessary to promote organic farming practices. Agricultural extension and advisory services play a significant role in promoting sustainable rural development and supporting the transformation of the convectional farming system to

an organic farming system (Baiyegunhi *et al.*, 2019; Kassem *et al.*, 2021).The advisory service provided by extension agents helps fluted pumpkin farmers to make informed farm-level decision by providing relevant information on time. Extension agents are fundamental information sources for farmers and play a crucial role in convincing farmers to adopt agricultural innovations such as organic farming practices (Alhafi *et al.*, 2021). Therefore, it is imperative to train extension agents on the idea, principles, management practices, and certification of organic farming in order to achieve transformative and sustainable agricultural development. Additionally, establishing organic producing companies to supply adequate inputs will play a key role in ensuring the availability, accessibility, and affordability of organic inputs among fluted pumpkin farmers. This will encourage farmers to adopt organic farming practices since the constraint of procuring organic inputs has already been ameliorated.

Other strategies for improving the adoption of organic farming practices among fluted pumpkin farmers were adequate funding of research institute on organic farming studies (M=1.45), technology should be based on farmers need (M=1.42), increased campaign and sanitization on organic farming (M=1.38) and development of an efficient market for organic products (M=1.31). These strategies are important for promotion of sustainable organic farming on vegetable crops including fluted pumpkins.

Table 5. Strategies to improve adoption of organic farming

Strategies to improve adoption	Mean	Standard Deviation
Increase extension service for dissemination of innovations	1.55*	0.589
Technology should be based on farmers need	1.42*	0.698
Improve farmers access to research on organic farming	1.33*	0.700
Establish organic producing companies	1.48*	0.667
Increase campaign and sanitization on organic farming	1.38*	0.675
Adequate funding of research on organic farming	1.45*	0.684
Development of efficient market for organic products	1.31*	0.601
Government should make policy to support organic farming	1.58*	0.564

Mean=1.0

4. Conclusion and Recommendation

The study concludes that organic farming is an all-encompassing production management approach that promotes and improves agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. Findings revealed that fluted pumpkin farmers depend on interpersonal channels such as fellow farmers, family members, and neighbors to obtain information on organic farming practices probably due to its relative cost, availability, and accessibility compared to other information channels. Therefore, it would be difficult for them to be aware of and create interest in new organic farming practices which are usually communicated through mass media such as radio and television.

There were several organic farming practices disseminated to fluted pumpkin farmers in the study area. However, adoption was slow with only animal manure being fully adopted by fluted pumpkin vegetable farmers, while other practices such as farmyard and compost manures were in the trial stage of adoption. The study also concludes that production/supply constraints, economic/market constraints, institutional/technical constraints and environmental constraints, slowed down adoption of organic farming practices.

The study therefore recommended that:

1. Government and all relevant stakeholders in agriculture should intensify awareness creation and sensitization on organic farming in crop production, especially vegetables, as this will ensure safer agricultural practices and reduce health risks associated with convectional production.
2. Government should establish organic producing companies in rural areas to ensure the provision of organic materials for vegetable production at a subsidized rate.
3. Government should enact a policy encouraging the adoption of organic farming practices by vegetable farmers and promotes certified organic produce in the market

Government, through the ministry of agriculture should train extension agents and fluted pumpkin vegetable farmers on effective application of organic manures on crops so as to get increased yield.

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