Research Article

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Factors affecting the acceptance of transferring innovations in the production of quality cassava stalk to farmers in Pathum Ratchawongsa district, Amnat Charoen province

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Abstract - The objectives were to study 1) personal and socio-economic factors 2) knowledge of cassava production, 3) acceptance of transferring innovations in the production of quality cassava stalk, and 4) problems and obstacles. The sample used in this research were 354 cassava growers, using interview forms for data collection. The study's results concluded that most of the farmers were male, average age of 50.57, not single, and education level below secondary school. The average number of household members was 4.90 persons, the average cassava planting area was 10.25 rai, and the average planting experience was 12.16 years. The average household size was 3.25 people with not a member of the farmer group, and without their own machinery. Most of farmers had an average income of 12,081.58 baht, and average expenses of 4,849.14 baht. Farmers knew how to produce quality cassava stalks at a high level of knowledge with an average of 26.16 points. There was a high level of acceptance of innovation in the production of quality cassava stalks with an average of 119.29 points. The hypothesis testing found that a member of the farmers group, having their own machinery and knowledge level were related to acceptance of transferring innovations in the production of quality

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cassava stalk significantly at the 0.01 level. The problems and obstacles encountered were planting labor and the price of labor wages was high. The shortage of water and the stalks where insufficient which government should support training and transferring innovations of quality cassava stalk to farmers.

Keywords: Transferring, innovation, production of cassava stalks, Amnat Charoen

1. Introduction

Cassava is a plant that grows in the tropics area. Cassava is a drought-tolerant plant that can be grown in all types of soils but suitable soil for planting is sandy loam and with low fertility. There are many types of cassava grown around the world, of which only *Manihot esculenta Crantz* (formerly known as *Manihot utilissima Pohl*) is commercially grown. Thailand is the world's major producer of cassava. The area with the most cassava cultivation was the Northeastern region, followed by the central region and the north region respectively by sweet (Sweet type) and bitter type (Bitter type). This type of cassava has a high starch content, commonly used in various processing industries.

Cassava is a food plant with high starch content (Carbohydrate-rich crops) and can be utilized in four main areas (4F): food, feed, fuel, and industrial factories as raw materials for ethanol production, bio-energy, such as alcohol, citric acid, machinery, clothing, drugs, paper, and chemicals, etc. From marketing is high demand for tapioca products, for use in animal husbandry and industry has increased, resulting in insufficient production areas to meet the demand. Therefore, the planting area has been expanding to other provinces especially in the Northeast, which is the most cultivated area of the country.

Thailand can grow cassava in every region and can be planted throughout the year, but most farmers will plant at the beginning of the rainy season (May to June) and the end of the rainy season (October to November) because planting during the rainy season produces higher yields of fresh bulbs than in other times in recent years. Cassava is often cheaper than other starchy crops. It can also be used as a raw material in various industrial sectors. The demand for cassava in the world market continues to grow slightly. As a result, cassava is the fifth most important food crop in the world after corn, wheat, rice, and potatoes which continued throughout the domestic market (Especially in the food industry and the ethanol industry) and the export market (67% of the total production in the country). According to the expansion of the Chinese market, which is the main market. As a result, the demand in China tends to recover especially in the animal feed and ethanol industry, which is a substitute product slightly declined together with the uncertainty in the price of produce depending on the climate and epidemic (Chaiwat, 2021). Consequently, cassava production in 2023 (starting to enter the market from October 2022 - September 2023) is expected to have a harvest area of 9.733 million rai, 32.730 million tons, and a yield per rai of 3.636 tons, compared to 2022 with a harvest area of 9.921 million rai with 34.068 million tons and yield per rai as 3.434 tons. Cassava was found that harvest area, yield, and yield per rai decreased by 1.89 percent, 3.93 percent, and 2.07 percent, respectively that may cause

by climate change and outbreak (Office of Agricultural Economics, 2023). Moreover, an important factor comes from being affected by drought, following the spread of diseases and insects such as cassava leaf spot disease. In addition, farmers also face the problem of a shortage of clean stalks for planting. (Prachachat Turakij, 2023).

From such consumption demand, there is a demand for clean and quality cassava stalks. Cassava has a high germination percentage, fast germination, and growth that competes well with weeds. Covering the area quickly reduces the labor and number of times weeding, reducing production costs raise productivity the stalk must not be too young or too old, and no diseases and pests in the plant. Cassava will have a low percentage of germination, slow germination, and slow growth in competition with weeds, outbreaks of diseases, and insect pests attached to the cuttings. Therefore, disease-free cassava stalks are needed. Especially from cassava leaf spot disease, which is caused by the cassava mosaic virus, a disease that affects the cassava industry in many countries. Because if the epidemic is severe, it may cause damage to the yield of up to 100 percent for Thailand.

Cassava leaf disease is a new emerging disease that was first found in August 2018 and is expected to be an outbreak from diseased cassava fields from neighboring countries with the tobacco whitefly as a vector to cassava growing areas in many provinces in Thailand such as Surin, Ubon Ratchathani, Buriram, Sisaket, Prachinburi, Chonburi, Chachoengsao, Nakhon Ratchasima, Sa Kaeo, Rayong and Kanchanaburi. Due to the use of diseased saplings for planting and an outbreak of the tobacco whitefly that is a vector (Department of Agriculture Extension, 2020). To solve this problem one of the research projects of Khonje *et al.* (2015) analyzed the acceptance and impact of improved cassava varieties in Zambia was found that adoption of improved cassava varieties led to a significant increase in production in terms of production, household income and food security which closely situation that happening in Pathum Ratchawongsa District located in the east of Amnat Charoen Province where is the outbreaks of cassava leaf spot disease highly presented and cassava farmers in the area have never been taught about innovation and technology for producing quality cassava stalks. Therefore, the researcher is interested in studying the production of quality cassava stalk and should be transferred to farmers who never get the knowledge innovations in the production of quality cassava stalk for growing cassava in the coming season is needed.

2. Materials and methods

This research is part of a project to research, develop and expand a network of producers of quality cassava stalk. The technology transfer has been carried out through learning by doing. Transferring innovations in the production of quality cassava stems to farmers in Pathum Ratchawongsa District, Amnat Charoen Province is quantitative research. The researcher has collected quantitative data by bringing the results to analyze the various factors affecting the acceptance of transferring innovations in the production of quality cassava stems to farmers in Pathum Ratchawongsa District. During January to March 2023, the research method details are as follows:

2.1 Population and sample

2.1.1 Sampling method

The population used in this study was the population of cassava growers registered with the Pathum Ratchawongsa District Agricultural Office, Amnat Charoen Province 2,852 cases. (Amnatcharoen Provincial Agricultural Extension, 2023) consisting of 967 farmers in Nong Kha Sub-district, 891 farmers in Khamphon Sub-district, 277 farmers in Na Wa Sub-district, 150 farmers in Lue Sub-district, 63 farmers in Non Ngam Sub-district and 282 farmers in Na Pa Sang Sub-district. By finding the proportional sample size and random sampling of farmers using Yamane's formula (Niyamangkul, 2013),

The sample size was 354 farmers by using a proportional stratified sampling and following by a simple random sampling method.

Table 1. Population and sample numbers classified by sub-district.

No.	sub-district	population (cases)	sample group (cases)
1	Nong Kha	967	120
2	Khamphon	891	110
3	Na Wa	277	34
4	Lue	150	19
5	Huai	63	8
6	Non Ngam	222	28
7	Na Pa Saeng	282	35
Total		**2,852**	**354**

2.2 Research tools

The research used an interview form to collect data. The interview form is divided into 4 parts, consisting of 1) personal and socio-economic factors 2) knowledge of cassava production 3) acceptance of transferring innovations in the production of quality cassava stalk to farmers and 4) problems and obstacles. Subsequently, bring the interview from 3 experts to check for validity. Then take the interview form to test with 30 cassava growers who have similar characteristics to the sample group and analyze. Reliability using the Kuder-Richardson formula of the KR-20 for knowledge of cassava production/ planting was 0.72 and Cronbach's alpha reliability coefficient was analyzed for acceptance of innovation transfer was 0.95. Interpretation of knowledge about cassava production/planting defines an interval scale (Niyamangkul, 2013), Knowledge of cassava production collecting data by dividing knowledge levels into 3 levels, set the scoring criteria as follows:

1) Positive questions answered correctly receive 1 point.

2) Wrong answer receive 0 point.

3) Negative questions answered correctly receive 0 point.

4) Wrong answer receive 1 point.

Interpretation data which can classify farmers' knowledge levels from 34 questions according to the average score range for considering the overall level of knowledge in cassava production/growing can be determined as follows:

The average score of 23-34 high level of knowledge

The average score of 12-22 moderate level of knowledge

The average score of 0-11 low level of knowledge

Acceptance of transferring innovations in the production of quality cassava stalk to farmers collecting data by questionnaire and interpretation of farmers' acceptance of transferring quality cassava seed production innovations is divided into 3 levels: by interpreting the level of acceptance of transferring innovations in the production of quality cassava stalks according to the average score range as follows:

The average score of 1.00 - 1.67 means acceptance at a low level.

The average score of 1.68 - 2.34 means acceptance at a moderate level.

The average score of 2.35 - 3.00 means acceptance at a high level.

2.3 Data analysis and processing

The data analysis was divided into 1) descriptive statistical analysis of personal factors, socio-economic factors, and knowledge about cassava production/planting, consisting of frequency, percentage, arithmetic mean, standard deviation, minimum and maximum values. and 2) analysis of the relationship between personal fundamentals socio-economic factors and knowledge about cassava cultivation and the acceptance of the transfer of quality cassava stalks production innovations of farmers in Pathum Ratchawongsa District, Amnat Charoen Province. By using the Chi-square statistic, the statistical significance was set at the 0.01 and 0.05 levels.

3. Result and Discussion

3.1 Personal factors

From the study was found that 80.5 percent of the sample group was male, and 70.9 percent of the farmers were aged between 46-55 years old with an average age of 50.57 years and 96.6 percent of farmers were not single. Regarding the level of education was found that 92.9 percent of farmers had an education below secondary school. The number of households members was found that 67.8 percent of farmers had 1-4 household members with an average of 4.90 household members. This corresponds to Saee-Art *et al*. (2019) studied Farmer's Adoption on Dry-Season Rice Production Technology in Kheuang Municipality, Chiang Khong District, Chiang Rai Province, was found that most of the off-season rice farmers were male, with an average age of 55 years old, graduated in lower primary education level, having marital status. This was normal for farming families in the northeastern region where the current farmers were older and received a basic education due to having to help the family work since childhood, and when married, still use family labor as the main worker.

3.2 Socio-economic factors

The study found that 98.3 percent of the samples had the most cassava planting areas of 1-24 rai, with an average cassava planting area of 10.25 rai, 59.0 percent of farmers had 1-13 years of experience in cassava cultivation, with an average of 12.16 years of experience in cassava cultivation. 99.2 percent of farmers had the largest number of workers, 1-7 persons with an average number of workers of 3.25 persons corresponding to Suwannapan *et al.* (2018) studying ways to promote vegetable production of farmers in Palan Sub-district. Phayakkhaphum Phisai District, Maha Sarakham Province, was found that farmers have an average household member of 3.98 people and an average number of workers in the household of 3.32 people. 77.4 percent of farmers were not members of the farmer's group. In terms of having their machinery, was found that most of the farmers, 69.8 percent, did not have their machinery. Regarding expenditures from cassava cultivation was found that 4,849.14 baht/year corresponding to Footan *et al.* (2017) studying Factors Affecting Farmers' Adoption in Good Agricultural Practices for Safe Vegetable Production in Mae Tha Nuea Royal Project Development Center, Chiang Mai Province was found that there was a cost to produce safe vegetables average 6,602.19 baht/rai and with an average income from cassava cultivation of 12,081.58 baht/year corresponding to Harinpaponwich *et al.* (2020) studying the integrated farming among agriculturists in Muang District, Yala Province, was found that the average income is 11,738.46 baht. Farmers received media exposure from personal media with 44.35 percent as farmers lived in the same area and had very close relationship corresponding to Tubtimthawechok (2013) studying Cognition and the Opinion of rice farmer on Income Guarantee Scheme in The Southern Isan provinces groups, Thailand was found that perception of the news of rice farmers in the southern Isan provinces regarding the Farmer Income Guarantee Project. There are important news sources from 3 sources: agricultural extension academics, village chiefs/heads, and BAAC employees, respectively.

3.3 Farmer's knowledge of cassava production

Farmer's knowledge of cassava production was found that from the full score of 34, farmers knew cassava production at a high level (23-34 points), the highest number with 88.1 percent, followed by knowledge about cassava production/planting at a moderate level (12-22 points) at 11.9 percent with an average score of 26.16 points, with the highest score 32 points and the lowest score 17 points (Table 2). According to this research it was found most farmers have been growing cassava for a long time and therefore farmers had a high level of knowledge about cassava cultivation. However, farmers had to study and gain knowledge and open to new innovations in growing cassava and always exchanging knowledge with each other consistent with Piangsub (2022) studying Thai Geographical Indications of Noh Kala (*Alpinia nigra Burtt*) in Koh Kret Sub-district, Pak Kret District, Nonthaburi Province found that most farmers who grow Noh Kala had a high level of knowledge about growing Noh Kala. The average knowledge score regarding planting Noh Kala was 10.46 points out of a full score of 12 points because farmers have been

growing Noh Kala for a long time. There was learning from practice, trial and error, memorization, and the transmission from generation to generation about the practices and techniques in growing Noh Kala until they were proficient. Therefore, farmers had a high level of knowledge about growing Noh Kala. Thus, the farmers had overall knowledge of cassava cultivation at a high level, consistent with Ketkaewkliang *et al.* (2014) studying the need for cassava production promotion farmers in Erawan District, Loei Province found that most of the farmers had the highest level of knowledge in cassava production. Followed by two-thirds of farmers with a high level of production knowledge and a few farmers had moderate knowledge of production. The farmers had an average knowledge of cassava production of 17.62 points.

Table 2. The overall level of knowledge about cassava cultivation of farmers

Farmers' knowledge of cassava cultivation level	Number of Samples	Percentage
High (23-34 points)	312	88.1
Moderate (12-22 points)	42	11.9
Low (0-11 points)	0	0.0
Mean = 26.16 S.D. = 2.679 Minimum = 32.00 Maximum = 17.00		

3.4 Adoption of the transfer of innovation in cassava stalk production to farmers

Accepting the transfer of cassava production innovation to farmers found that the overall acceptance of cassava stalk production innovation was at a high level with an average score of 2.803 points. Considering each aspect, was found that the farmers gave the most acceptance for the selection of stalks (a mean score of 2.948 points), followed by the method of stalk preparation (mean score of 2.947), harvest (mean score of 2.918), quality control (mean score of 2.810), fertilizers/chemicals used (mean score of 2.730), and cultivar (average score 2.466 points), respectively (Table 3). Possibly since most farmers have been growing cassava for a long time. Therefore, the research found that the selection of cultivar was very important in cassava planting, especially the production of quality cultivar that affected the yield. Consistent with Praphaisri *et al.* (2014), a study of farmers' acceptance of in-season rice production methods in Mae Ai District Chiang Mai Province, found that farmers accepted and applied the method of rice production in the planting and harvesting methods at a high level. This is because currently, farmers are more open to knowledge and accept the transfer of new crop production innovations in various fields that are relevant to themselves from relevant officials. Consistent with Daengfai (2018) studying adoption of maize legume relay cropping system grown without burning of farmer in the area of highland development project using Maesalong Royal Project system, Maefahluang District, in Chiang Rai Province, found that the knowledge of the informant related to accepting a system of growing maize for animal feed by using a method that does not burn crop residues and interspersed with legumes (sig.<0.05). Since, the outbreak of cassava leaf spot disease has become more serious and the

quantity of cassava stalks that farmers can use for planting in next season is insufficient. Therefore, transferring innovations in the production of quality cassava stalk to farmers is needed.

Table 3. Adoption of the transfer of innovation in cassava stalk production to farmers

Production of quality cassava stalks	$\bar{X}$	S.D.	Acceptance level
Cultivar	2.466	0.511	moderate
Fertilizers/chemicals used	2.730	0.541	high
Quality control	2.810	0.494	high
Harvest	2.918	0.298	high
Stalk preparation	2.947	0.238	high
Selection of stalks	2.948	0.221	high
Total	**2.803**	**0.384**	**high**

3.5 Relationship between personal factors and acceptance of cassava stalk Innovation.

The study found that farmers' membership and acceptance of innovative production of quality cassava stalks were correlated at the statistical significance level of 0.01 as most farmers were not the member of the group but they had very close relationship which made them strong in term of group working consistent with Fakkhong and Suwanmaneepong (2017) studying the practice of good agricultural practices among rice farmers in the eastern region of Bangkok, Thailand, the research found that membership in agricultural organizations was significantly associated with acceptance of knowledge from agricultural extension and understanding (Good Agricultural Practices) GAP rice production at the 0.01 level for exchanging knowledge on the production of quality cassava cultivars.

Farmers had their own machinery and their acceptance of innovative production of quality cassava cuttings were found to correlate with the statistical significance level of 0.01, farmers already had knowledge in producing cassava stalks but in the traditional way, so they can easily accept the innovation in producing cassava stalks as help them to produce the high quality of cassava stalks consistent with Arif *et al*. (2018) studying influencing factors. On Improved Cultivation Adoption: A case study of peach farmers in Pakistan found that ownership of machinery had a significant positive effect on IC adoption. The adoption of technology increased by 10.1% if farmers had their farm machinery. Most farmers do not have their machinery because most farmers are small farmers coupled with expensive machinery farmers do not have enough capital to buy their crops.

Knowledge and acceptance of quality cassava stalks production innovation among farmers were found to be correlated at a statistical significance level of 0.01, as farmers has long experience on growing cassava, face many problems and welling to learn a new knowledge consistent with Ruangtanaapaisuk *et al.* (2021) studied

Needs of Knowledge on Geographical Indications Registration of Large-Scale Taro Farmers in Ban Mo District, Saraburi Province found that farmer knew taro cultivation at a high level had a significant relationship with Needs of Knowledge on Geographical Indications Registration of Large-Scale Taro Farmers acceptance of farmers at the 0.01 level. Because farmers already knew in producing cassava stalks, they are easily accepted in the new cassava seed production innovation as needed to improve the quality of cassava plantation.

Table 4. Relationship of personal factors and quality cassava cutting production of farmers Pathumratchawongsa District, Amnat Charoen Province

Factors	The level accepts the innovation in the production of quality cassava cultivars by farmers.		
	X^2	P-value	Significance
Farmer's Membership	4.684**	0.030	Sig.
Own machinery	5.618**	0.018	Sig.
Knowledge	6.587**	0.000	Sig.

** Significance level at 0.01

4. Conclusion

Male farmers who received the innovation for producing quality cassava stems with an average age of 50.57 years, 96.6% were unmarried, 92.9% had lower than secondary education, with an average number of household members of 4.90 people, with an average cassava planting area of 10.25 rai. They had experience in cassava cultivation and had an average of 12.16 years with an average number of laborers of 3.25 people. Farmers were not members of the group with 77.4%, did not have their machinery with 69.8%, and had an average expenditure from cassava cultivation 4,849.14 baht/ year with an average income from cassava cultivation 12,081.58 baht /year. The farmers had a high level of knowledge about cassava cultivation and the farmers accepted the transfer of innovation in the production of quality cassava stalks at a high level. Farmer's membership, own machinery, and knowledge were found to be correlated at a statistical significance level of 0.01. Problems and obstacles in producing quality cassava stalks of farmers were found that labor in planting was scared at present with wages high. Water shortage due to seasonal rain and water in natural water sources was insufficient and the cost of fertilizers and herbicides was high, that increasing the cost. In harvesting, there was a problem with rotten roots and the price of cassava went up and down all the time and the cultivars used for planting were insufficient. Government agencies should be included as an urgent national policy regarding problem of the outbreak of cassava leaf spot disease and including transferring innovations in producing quality cassava stalks to farmers in other areas or creating network communities to increase the amount of production of quality cassava stalks.

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