

Quantifying farmer's willingness and perception towards grain corn cultivation

(Mengukur kesanggupan dan persepsi petani jagung manis terhadap penanaman jagung bijirin)

Nor Amna A'liah Mohammad Nor*, Murni Azureen Mohd Pakri*, Nik Rahimah Nik Omar*, Mohd Syauqi Nazmi*, Ahmad Zairi Zainol Abidin*, Mohd Rashid Rabu* and Nurul Huda Sulaiman*

Keywords: farmer, willingness, perception, grain corn

Abstract

The cultivation of grain corn is deemed to be a new source of wealth in Malaysia. This is a step towards the country's food security as Malaysia had always been dependent on imported grain corn, mainly from Argentina and Brazil. The use of grain corn is different from the consumption of sweet corn, as sweet corn is used as human food while grain corn is used as an animal feed and food products. The country is highly dependent on imported grain corn and this is quite worrying as it affects the deficit in the country's trade balance and creates instability and risks food security. These concerns have led to local grain corn production in 2016 that continues till today. The method of growing grain corn is very similar to cultivation of sweet corn. It is the matter of willingness and acceptance of farmers to shift to a new crop, to suit the demand of the country. Hence, this study aims to identify the willingness and perceptions of sweet corn farmers on venturing into grain corn industry. A survey consisting of 155 registered sweet corn farmers was conducted throughout Malaysia by methods of structured questionnaires and in-depth face to face interviews. The findings show that farmers are not willing to convert their crops to grain corn cultivation. However, if they are given new land and additional incentives, they are eager to plant grain corn. The findings clearly show that the profit margin for sweet corn is higher than grain corn. The total production cost of grain corn is RM0.78/kg compared to sweet corn, which is only RM0.22/cob. These considerable differences in profit and costs make it difficult for farmers to switch from sweet corn to grain corn. Optimisation needs to be done to increase yields and reduce production costs of grain corn to be competitive and profitable for farmers.

Introduction

Corn (*Zea mays* L.) is one of the short-term crops which is widely grown around the world, including Malaysia. It is the third most important cereal crop worldwide after wheat and rice (Suleiman et al. 2013). Corn is divided into two types, namely sweet corn and grain corn. Grain corns are produced

from type *Z. mays indurata* or *Z. mays indentata*, while sweet corn is a type of *Z. mays saccharate* (Iltis and Doebley 1980). Sweet corn is mostly produced as food for humans that is often served after boiling or roasting, while the cob can be processed for animal feed. Its sweetness and taste is the reason for preference among Malaysians,

*Socio-Economy, Market Intelligence and Agribusiness Research Centre, MARDI Headquarters, Persiaran MARDI-UPM, 43400 Serdang, Selangor

E-mail: amna@mardi.gov.my

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especially children. Meanwhile, grain corn is a cereal food or can be processed into food products such as corn oil, flour and animal feed. It has competitive uses in the industrial production such as ethanol and polylactic acid (PLA) and the primary raw material for monogastric animal feeds such as chicken and swine.

In comparison, the planting period for these two corns are quite different. The sweet corn is a short-term crop where the planting period and harvest are around 68 to 72 days (Khasim et al. 2010). Meanwhile, the harvesting period is rather longer as for the grain corn reaching between 100 to 120 days depending on the planted variety, percentage of specific grain moisture content, and weather during the harvesting period (Abu Bakar et al. 2020). Typically, grain corn cultivation requires 110 days to ensure the grain corn achieves a minimum drying rate of 20 to 25 percent (Beck’s Hybrid 2014 and Syarifuddeen et al. 2020). Due to this, most of the sweet corn farmers prefer planting sweet corn instead of grain corn (Anon 2015).

The main concern for agropreneuers to invest in commercial grain corn plantations is due to a lack of information since this is a new industry in Malaysia. Pilot studies are still underway and are being improvement are being made. Till few years ago, there was no commercial grain corn production that produced animal feed in Malaysia as most corn produced in the country were sweet corn for human consumption. Sweet corns are planted 2 to 3 times a year or in rotation with other crops such as banana, sweet potatoes, pineapple and watermelon to complement farmers’ income.

To support local needs of grain corn, Malaysia imported almost 100% of grain corn. Mainly from Argentina and Brazil (93%) and the rest from the United States of America (U.S.A.), Thailand, Myanmar, Pakistan, and Indonesia (7%) as an ingredient for animal feed formulation (Mohammad Nor et al. 2020 and USDA 2020). High dependency on the world’s grain corn supply to support the country’s livestock industry might affect our national food security as well as the trade deficit balance and risks industrial instability, worsened with economic turmoil, price, and market instability. Hence, the government through the blueprint action plan targets to produce 1.44 million metric tonnes of local grain corn, utilising 80,000 ha of land by 2032 (Grain Corn Blueprint 2017). To ensure this goal is achieved, one of the objectives of this study was to evaluate farmer’s acceptance towards planting grain corn in their fields. Therefore, a survey was conducted among the sweet corn farmers to assess their acceptance to cultivate grain corn for animal feed production to meet domestic demands. They were chosen due to the similar methodology of growing grain corn and sweet corn.

Literature review

In most countries, the agricultural sector remains an essential component in driving economic growth. Moreover, it’s contributions are invaluable as a prominent income generator for developing countries and under-developed nations. In Malaysia, agriculture is seen as an enigma of growth that provides much-needed income, particularly for the rural community

Table 1. Differences between grain corn and sweet corn

Parameters	Grain corn	Sweet corn
Scientific names	<i>Z. mays indurata</i> or <i>Z. mays indentata</i>	<i>Z. mays saccharate</i>
Uses	Livestock feed	Human consumption
Planting period	110 – 120 days	68 – 72 days
Harvesting conditions (cobs)	Dried 20 to 25 %	Fresh cobs

(Bahaman et al. 2010). Hence, the agriculture sector should not be neglected but rather given more attention as it is an important instrument to fight instability of food production and food insecurity.

Bongaarts (1996) mentions that in order to ensure food security for the world's population by 2050, it would be necessary to double up yields, increase total planted area and intensify harvest frequency. The development of maize varieties adapted to the new climatic conditions is vital for future food production (Challinor et al. 2016). On the other hand, Guo et al. (2005) mentioned that continuous support from various stakeholders such as policymakers and agricultural agencies is significant in ensuring that the farming entrepreneurs continue to practice agriculture. The same goes for the cultivation of grain corn, where farmers need full support from the government and agencies in providing training and knowledge support to start the grain corn cultivation and help farmers sustain the grain corn cultivation over the years by adopting new technology to increase yield and minimise production costs.

In 2020, Malaysia imported 4.1 million tonnes of grain corn to fulfil livestock feed demand (IndexMundi 2021). The main challenge to produce grain locally is that the cost of imported grain corn is much cheaper than the cost of domestic production. It was the main reason that the government decided not to cultivate grain corn back in 1987 (Mohammad Nor et al. 2019). In early 1987, during the government's initial effort to start corn cultivation initiatives in Malaysia, the grain corn price was adjusted to RM0.43/kg, while the production cost was up to RM1.00/kg (Grain Corn Blueprint, 2017). However, the current price of grain corn in the world market seems to be unstable and ranges from RM0.70 – RM1.20/kg (Grain Corn Blueprint 2017). The instability of the grain corn price is due to changes in demand factors such as increased world oil prices, natural disasters that destroyed yields and

increased ethanol usage from corn grains (Eldukhery et al. 2010). For developing this industry in Malaysia, a complete package of standard operating procedures (S.O.P.) with technology in place should be established to ensure the production was viable for the industry to invest. As for now, dried grain corn in the world market showed a feasible price for farmers to import rather than produced it locally.

Bellon (1991) showed that farmers are not a homogeneous group and their preferences and priorities are highly heterogeneous. Many determining factors affect farmers' choice of changing their crops. Their selection depends on the final product attributes, socioeconomic variables, opinions and attitudes, risk perception, the socio-cultural environment, and the amount of information they can access (Hellyer et al. 2012). For sweet corn farmers, although most of the practice are similar, it still required them to gain extra knowledge and skills to cultivate grain corn.

The most important factor considered by farmers are greater yields and flattening resistance. Therefore, the engagement of farmers towards their willingness to accept cultivating grain corn must include better productivity as well as complete technology practices. Consequently, if farmers adopt only improved varieties instead of a package that includes fertilisers, better sowing methods and management practices, the results will not affect the crop's productivity (Karanja et al. 2003).

Methodology

In this study, the mix method were used whereby the survey through questionnaire and in depth interview of the farmers were done. The survey involved 155 sweet corn farmers in several states throughout Malaysia as target respondents. This study aimed to explore farmers' willingness to switch towards planting of grain corn. The questionnaire is a mix of close-ended questions and open-ended questions that comprises socio-demographic profile,

farmers willingness, the need for incentives and farmers' views on grain corn cultivation. The survey instrument also contained a brief background about the grain corn and the comparison with the sweet corn. The willingness of farmers was recorded after the numerators gave the information on the needs of grain corn in the country, the technical difference with sweet corn whether in terms of cultivation, use, production costs, yield, sales and so on.

The survey was conducted through face-to-face interviews using a structured questionnaire (survey). The farmers are randomly selected by the Departments of Agriculture (DOA) from the respective state. The data obtained from respondents were analysed using descriptive methods. This method is calculated to reflect general information from respondents. Therefore, the primary data will generate information such as a respondent's profile, their knowledge of grain corn, their willingness to accept the grain corn cultivation, and the benefit and impacts of cultivating grain corn or sweet corn. The interviews were held at a convenient place and took up between 45 to 60 minutes for a session.

Research findings

Socio-demographic profiles of farmers

In identifying the cultivation area for grain corn in Malaysia, stakeholders consider substituting sweet corn cultivation with grain corns due to limited land readily available for large scale planting. Therefore, there is competition in determining the type of crops to be cultivated by farmers. Therefore, a questionnaire was constructed to evaluate the willingness of sweet corn farmers to cultivate grain corn. A total of 155 respondents participated in the survey.

Table 2 shows the socio-demographic profile of the respondents comprised of 80.6% of men while the rest, 19.4% are women. This is not surprising as it is commonly known that men dominate the agricultural sector, especially on farms. The age of farmers varied between 24 to

80 years, with the majority above 51 years old (54.9%). The age factor is indeed one of the main issues that are often discussed in the agricultural sector, which indicates the seniority of the people in the industry. Youths are less interested in venturing into agro-industry but prefer the industrial and services sectors as their career of choice. They perceive that the agricultural sector is a sector classified as 3D, that is dangerous, dirty, and difficult (Ahmad et al. 2018).

There is also an unequal distribution in terms of race whereby the Malays are the majority involved in sweet corn farming. With regards to educational level, most of them have at least a secondary education certificate, while only 12.9% of them have been to the college. A total of 44.5% of farmers focused on sweet corn as their primary crop, while the rest indicates that sweet corn as an additional source of income. Based on the study conducted, 39.4% of farmers have less than five years of experience in cultivating sweet corn, while 22.6% have experience ranging from 6 to 10 years, and the rest have more than ten years of experience. It shows that most of the farmers have less than 10 years of experience in sweet corn, and it covers the various level of age while farmers who gained experience more than 20 years are mainly at the age 51 years and above.

Willingness of grain corn cultivation

One of the emerging sub-themes within the acceptance of grain corn cultivation is farmers' knowledge regarding grain corn. It showed that 66% of them either had limited knowledge or no knowledge at all regards to grain corn cultivation (*Figure 1*). Meanwhile, 33.5% of farmers are well versed in the grain corn industry. On the other hand, the majority of the sweet corn farmers (96.8%) have never been involved in the grain corn projects, while only 3.2% have been involved in grain corn projects. As the knowledge on grain corn industry is still scarce, it is pretty challenging to attract sweet corn farmers to participate

Table 2. Socio-demographic profiles of sweet corn farmers

Variable	Category	Frequency	Percentage (%)
Gender	Male	125	80.6
	Female	30	19.4
Age	24 – 30 years old	14	9
	31 – 40 years old	29	18.7
	41 – 50 years old	24	15.5
	51 – 60 years old	39	25.2
	61 – 70 years old	39	25.2
	>70 years old	7	4.5
Race	Malay	150	96.8
	Indian	2	1.3
	Chinese	3	1.9
Education	Primary school	42	27.1
	Secondary school (SRP/PMR)	33	21.3
	Secondary school (SPM)	57	36.8
	Diploma/STPM/Certificate	9	5.8
	Degree and above	11	7.1
	Others	3	1.9
Main occupation	Sweet corn farmers	69	44.5
	Sweet corn and other crops farmers	73	47.1
	Business	1	0.6
	Government sector	2	1.3
	Private sector	3	1.9
	Others	7	4.5
Experiences in sweet corn cultivation	<5 years	61	39.4
	6 – 10 years	35	22.6
	11 – 15 years	16	10.3
	16 – 20 years	13	8.4
	21 – 25 years	6	3.9
	26 – 30 years	7	4.5
	>30 years	4	2.6

in this industry. Cooperation between all stakeholders needs to be strengthened to ensure all information, innovation, technology transfer and technical support reach the target group.

A few criterias that influences the decision of farmer's acceptance are as relative advantage, compatibility, complexity, observability and reliability

(Rogers 1995). Discussion with farmers revealed that 73.5% are unwilling to switch from sweet corn to grain corn unless they are provided with new land area and as long as their existing crop field is not affected. Most farmers look forward to government support such as subsidies and incentives to boost the growth of the grain corn industry. The majority of the farmers (90.3%)

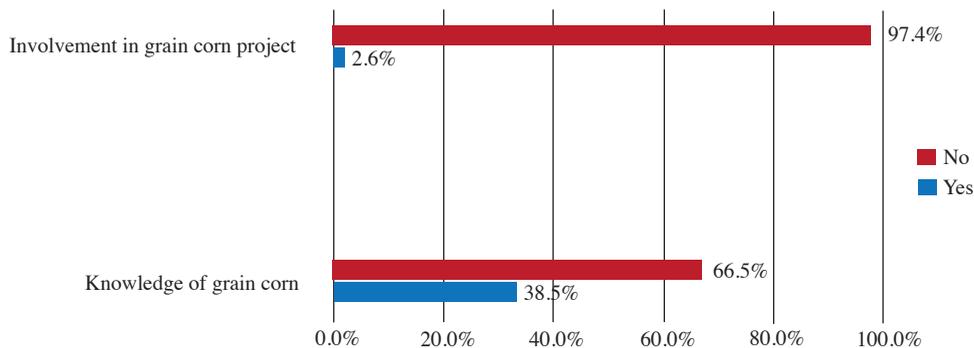


Figure 1. Farmers' knowledge and involvement in grain corn

indicate that they are not willing to cultivate grain corn without incentives from the government. More than 80% of the farmers also required assurance in price stability and guaranteed minimum price (G.M.P.) before making any decisions in cultivating this new crop (Table 3). The price control of grain corn is vital that prevents grain corn prices from falling too low and secures farmers financial assistance as most of them are small-scale farmers with insufficient savings and capital.

For new crops such as grain corn, an important indicator such as economic viability and technical characteristic (variety with high quality and yield, resistance to pests and diseases, technology, etc.) as well as price should be in place to attract farmers to plant the crop.

Table 4 shows the advantages and disadvantages of grain corn and sweet corn. This will help farmers decide whether to accept or reject the industry and reduce the risks that they will face. As listed below, there is more advantage of planting sweet corn as compared to grain corn. In terms of planting period, sweet corn requires a shorter period of 70 days compared to grain corn which needs longer timer, approximately 110 days. In addition, sweet corn can directly be sold after harvest because it is for fresh use. Grain corn on the other hand, needs to go through a post-harvest drying process first. Even post-harvest procedures are quite complicated

because it requires the appropriate moisture content to ensure the quality of grain corn.

In terms of cost and profit, sweet corn shows a higher profit because sales are done in the form of cob while grain corn is sold in the form of grains by weight. It is estimated that 1 kg of grain corn requires 4 to 10 cobs of grain corn depending on the quality of the corn. This might be the main reason why most of the sweet corn farmers were not willing to change to grain corn. The current estimated gross income showed a massive difference for the sum per ha. While other indicators such as higher cost of production, longer cultivation period, which allows only two cultivation per year for grain corn, means less preference will be given to this crop.

Conclusion and recommendations

Malaysia heavily depends on imports for grain corn as a source of animal feed, mainly from Argentina and Brazil. Therefore, the cultivation of local grain corn has been included in the New Sources of Wealth (SKB) initiative during Eleventh Malaysian Plan (11th MP) as one of the strategies to empower grain corn cultivation. Cultivation of local grain corn aims to reduce imports and stabilise the increase of price in livestock to ensure food security. Besides that, it will indirectly help in reducing foreign exchange and offer a reasonable price to consumers.

Table 3. Farmer's Willingness

Variable measured	Indicator	Percentage (%)
Willingness to change from sweet corn to grain corn	No	73.5
	Yes	26.5
	Sweet corn	44.5
	Abandoned land	89.0
	New area	86.5
Cultivation without the funds from the government	No	90.3
	Yes	9.7
Government Policy	Pricing policy	87.1
	Price guarantee policy	93.5

Table 4. Comparison of benefits in grain corn and sweet corn

Parameter	Grain corn	Sweet corn
Cultivation time	110 days	70 days
Cultivation per year	Two times	Four times
Distance per tree	20 x 75 cm	50 x 75 cm
Plant density	66,666 trees	53,000 trees
Seed usage per ha	20 kg	10 kg
Seed price	RM15/kg	RM160/kg
Average yield (tonne@cobs/ha)	6.5 tonnes	26,500 cobs
Farm Selling Price	RM1/kg (1kg = 4 –10 cobs)	RM0.75/cob
Gross Income	RM6,500/ha	RM19,875/ha
Production Cost (RM)	RM 0.78/kg	RM 0.22/cob
Market	Livestock feed	Human Consumption

To support the aspiration of producing grain corn in large areas, full participation and commitment from farmers is required. However, the results showed that sweet corn farmers are generally not willing to substitute for grain corn. Some of the farmers who are willing to accept cultivating the grain corn requires incentives provided by the government as well as a need for new planting areas. The factors that affect most of the farmers for not cultivating grain corn are high production costs, lower gross income, and less cultivation per year due to more days of planting.

This will be a challenge in strengthening the grain corn industry in Malaysia. Various things need to be done, especially in increasing yields and reducing production costs so that the grain corn industry is competitive and profitable for farmers, as well as attract their interest to venture into this industry. In addition, the lack of exposure, knowledge and awareness regarding grain corn prevents farmers to take risks to try. Therefore, complete information on grain corn such as cultivation agronomy, the latest technology of grain corn cultivation, planting potential and viability, post-harvest handling and other related information should be disseminated

to farmers so that they are aware and exposed about this industry. Hereby, it can help in reducing the country's dependency on imported grain corn as well as diminish the country's deficit balance and ensure the country's food security and sovereignty.

Acknowledgement

Utmost appreciation is extended to those involved in the success of this study, especially all staffs from Socio-Economy, Market Intelligence and Agribusiness Research Centre, MARDI. Not forgetting, a big thanks to MARDI's grain corn team members, Department of Agriculture (DOA) and all agencies of the Ministry of Agriculture and Food Industries (MAFI) for their assistance and support.

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Abstrak

Penanaman jagung bijian telah menjadi salah satu sumber kekayaan baharu di Malaysia. Ini bagi memastikan keselamatan dan kedaulatan makanan negara terjamin kerana negara telah mengimport jagung bijian sepenuhnya dari negara luar khususnya Argentina dan Brazil. Penggunaan jagung bijian adalah berbeza daripada penggunaan jagung manis di mana jagung manis digunakan untuk makanan manusia manakala jagung bijian digunakan sebagai makanan haiwan dan produk makanan. Kebergantungan negara kepada jagung bijian yang diimport agak membimbangkan kerana ia menjejaskan defisit dalamimbangan perdagangan negara dan mewujudkan ketidakstabilan dan risiko di dalam jaminan keselamatan makanan. Kebimbangan ini telah menyebabkan negara menghasilkan jagung bijian tempatan pada tahun 2016 dan berterusan sehingga kini. Amalan penanaman jagung bijian yang hampir sama dengan jagung manis menimbulkan tanda tanya sama ada petani jagung manis sanggup menukar tanaman mereka kepada tanaman jagung bijian. Justeru, kajian ini bertujuan untuk mengenal pasti kesediaan dan persepsi petani jagung manis dalam membangunkan jagung bijian sebagai industri baharu. Tinjauan terhadap 155 petani jagung manis berdaftar telah dijalankan di seluruh Malaysia melalui soal selidik berstruktur dan temu bual mendalam secara bersemuka. Penemuan menunjukkan bahawa petani tidak bersedia untuk menukar tanaman mereka kepada penanaman jagung bijian. Namun, jika mereka diberi kawasan dan insentif, mereka bersedia untuk menanam jagung bijian. Dari segi perbezaan antara jagung bijian dan jagung manis, jelas menunjukkan margin keuntungan bagi jagung manis adalah lebih tinggi daripada jagung bijian. Jumlah kos pengeluaran jagung bijian ialah RM0.78/kg berbanding jagung manis iaitu hanya RM0.22/tongkol. Perbezaan besar dalam keuntungan dan kos ini menyukarkan petani untuk beralih daripada jagung manis kepada jagung bijian. Ini merupakan cabaran dalam memperkasakan industri jagung bijian di Malaysia kerana industri ini masih belum kukuh dan rapuh. Pelbagai langkah perlu dilakukan terutamanya dengan meningkatkan hasil dan mengurangkan kos pengeluaran supaya industri jagung bijian berdaya saing dan menguntungkan petani serta mampu menarik minat petani untuk melibatkan diri dalam industri ini. Seterusnya, pendedahan yang mendalam mengenai jagung bijian perlu disediakan bagi memastikan petani mendapat maklumat yang diperlukan dari segi penanaman dan potensi, sekali gus dapat menarik minat mereka untuk menceburi industri ini.

