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The Impacts Contract Farming on Cultivation and Postharvest Practices on Red Chili Farm in Magelang District, Indonesia

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***Abstract*---**Contract farming refers is to carry out the agreement between the buyer and the farmer to reduce risk for both parties. Red chili is rotten, damaged, and has a large shrinkage, causing production, quality and price risks. The study provide an empirical analysis of the impact of contract farming on chili cultivation and postharvest practice. The field survey was conducted in Magelang District as the one of the production centers of red chilies in West Java. Data collected from 40 farmers for contract and 45 farmers for noncontract. The results of the study indicated that the cultivation and post-harvest practices on contract farmers are better in quality, as well as in quantity compared to non-contract farmers. In contract farming, cultivation and post-harvest practices done by farmers are controlled by growers as representatives of the company. Tight control over the products produced by farmers generates not only for the better quality, but also the increase chili farm productivity. Contract farming is recommended to apply other agricultural commodities, specially for high risk commodity which has wid price fluctuation, high quality variation, and susceptible to climate changes.

***Keywords*---**contract farming, high risk commodity, increased production, postharvest practices, red chilli.

Introduction

Recent consumers prefer to products which has quality assurance and food safety. The application of the Standart Operating Procedure (SOP) is a quality

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control process so that the quality of products produced by farmers is guaranteed quality and can be accepted by the market. The Standart Operating Procedure (SOP) was created to facilitate increased access and sale of quality agricultural products in the domestic and local markets (Dina et al., 2012). Contract farming may help facilitate technology transfers and improve productivity. Often, the processor imposes technical standards on crop growers. To help growers achieve this standard, the processor may provide inputs such as seeds and chemicals for crop growers and agriculture assistance for chili growers. They also provide technical training and other consulting services as part of the contract (Wang et al., 2014).

Central Java Province is the third-largest producer of red chili. Magelang Regency is one of the large red chili production centers in Central Java which accounts for 10-11% of red chili production in Central Java or 1.5-2.0% of total national production. The average productivity of red chili in Magelang Regency varies, which is 5.49-7.20 tons/ha. Red chili farmers in Magelang regency have been doing contract farming with Indofood company since 2015. Red chili is one agricultral commodity that has a high risk in terms price fluctuation, high quality variation, and susceptible to climate changes. Red chili is rotten, damaged, and has a large shrinkage, causing production risk, quality risk (quality, and price risk) (Saptana et al., 2010).

One approach to reducing risk is by collaborating in the form of contract farming. Contract farming is a partnership that leads to improving quality and safety for consumers and reducing risk and increasing productivity for farmers (Wang et al., 2014). Contract farming refers to agricultural production which is carried out according to an agreement between the buyer and the farmer, by setting conditions for the production and marketing of agricultural products (FAO, 2013). The farmer will provide a certain amount of a certain commodity at the specified quality and time standards, and the buyer is committed to a specific pricing scheme. Buyers can also provide some input or technical support to farmers. The advantage of contract farming for farmers is that the core company that buys the results can provide technical guidance for cultivation and postharvest, as well as accommodate the results and carry out processing and marketing (Bellemare, 2012; Ton et al., 2018).

With the contract farming partnership in Magelang Regency, it is expected to overcome the problems of red chilli farmers. Therefore, this research needs to be done to analyze the effect of cultivation and postharvest practice in contract farming on increasing the production and productivity of red chili farmers in the Magelang district. This study compares cultivation and postharvest practice between contract farming and noncontract farming, then provides an empirical analysis of the impact of cultivation and postharvest practice in contract farming on increasing farmers' production and productivity in the Magelang Regency. Contract farming is considered to be able to increase production, so that it can be used as a program to increase partnerships (Hallett, 1984; Craighead et al., 2021).

Research Method

Research was conducted July- September in Magelang Regency Central Java Province which is one of the centers of red chillies. Total respondents 85 farmers consisting of 40 contract farmers who have a contractual relationship with Indofood for five years and 45 non-contracted farmers. The author conducted semi-structured interviews and observation with 85 farmers. Semi-structured interview was conducted to obtain data seed supply, fertilization, and pest control. Observation was conducted to find data land preparation, planting, and postharvest. The analytical method uses the descriptive and T test. Descriptive tests are used to see differences in the application of cultivation and post-harvest practice between contract and non-contract farmers, while the T test is done to see differences in red chillies production and productivity between contract and non-contract farmers (Liu et al., 1996; Maes et al., 1998).

Result and Discussion

Comparison cultivation practice of contract farming farmers and non contract farming farmers

Table 1
Descriptive analysis of comparison between contract and non-contract farmers

Action	Activity	Contract Farmer	Non Contract Farmer
Seed Supply			
	Seed Origin	Grower and has been certified by BPSB (Balai Pengawasan dan Sertifikasi Benih)	Farmers buy themselves into a breeder or factory that has been certified by BPSB
	Varieties Determination	Determined by PT. Indofood	It's up to the farmers
	Varieties	Novis, Imperial, Imola, Baja, Impala, Hot Chili, Hot Beauty, Biola, Gada, Laras	Gorga, Baja, Novis, TM 99,Tropy, OR.42, Jacko
	The average number of seeds	3.410 stem/ 0,17 ha	4.036 stem/ 0,20 ha
	Seed Form	The form of seedlings in polybags rom grower	Some are in the form of plants in polybags, there are seeds in the form of seedlings by farmers themselves
	How to make seeds	The grower brings a sample of the seed to be tested by the partner company, then the partner company will	Farmers contact breeders or buy factory seeds and then seed in their seedlings by farmers

		announce whether the seed passed or not to be developed by the grower to farmers	
Land Preparation	Land Processing	The soil is processed first until it is loose, then left for 14 days. The next stage, soil formed beds	The soil is processed first until it is loose. Then left 7 days. The next stage, soil formed beds
	Making beds	Making beds with length = 8, 2 m, width = 108 cm, height = 30 cm, distance = 52.25 cm, planting distance = 50 x 50 cm	Making beds with length = 7.9 m, width = 83.77 cm, height = 21.77 cm, distance = 79.33 cm, planting distance = 50 x 50 cm
	Calcification	Calcification was done with dolomite with an average of 170.5 kg per 0.17 ha	Calcification was done with dolomite with an average of 199.78 kg per 0.20 ha
	Basic Fertilization	Fertilization is carried out with organic fertilizer namely manure and NPK fertilizer.	Fertilization is carried out with organic fertilizer namely manure and NPK fertilizer.
	Mulch Making	Mulching is made, using MPHP (Black Silver Plastic Mulch) at the top of the bed.	Mulching is made, using MPHP (Black Silver Plastic Mulch) at the top of the bed
	Punching the Mulch	Mulch that has been installed perforated	Mulch that has been installed perforated
Planting	Seed Age	Seeds that are planted averaged 22.22 days	Seeds that are planted reach an average of 31.22 days
	Plant spacing (cm)	The average distance between plants is 52.25 cm	The average plant spacing is 53 cm
	Line spacing (cm)	The average distance between lines is 54.5 cm	The average distance between rows is 56 cm
	Planting time	For planting time farmers do planting synchronously in the morning	For planting time farmers do planting synchronously in the morning
Marker Installation	Marker Installation	Marking is done	Marking is done
	Type of Marker	Bamboo	Bamboo
	Size of stake	100 cm	115 cm

Stamp	Stamp	Stamp did	Stamp did
	Age of plant buds	15 HST	20 HST
	Age of plant foliage	75 HST	80 HST
Irrigation	Type of irrigation	Rainfed	Rainfed, surface irrigation
	Watering Time	During the dry season use a pump that is sucked from a spring	Irrigation: 1 HST plant age, 7 HST, 14 HST, 21 HST with 2hours irrigation.
Rainfed: During the dry season use a pump that is sucked from a spring.			
Fertilization	Fertilizer Resources	Kiosk	Kiosk, KUD
	Type of Fertilizer	NPK, ZA, SP-36, and POC	NPK, ZA, SP-36, and POC
	Age of fertilizing plants I	21 days	30 days
	Age of fertilizing plants II	42 days	60 days
	Age of fertilizing plants III	63 days	90 days
Pest Control			
Types of Pests and Diseases	Thrips, Yellow mites, fruit flies, aphids, armyworms, white lice, bacterial wilt, fusarium wilt, anthracnose fruit rot, leaf spot disease, geminivirus, mosaic virus	Thrips, Yellow mites, fruit flies, aphids, armyworms, white lice, bacterial wilt, fusarium wilt, anthracnose fruit rot, leaf spot disease, geminivirus, mosaic virus	
	Control Type	Pesticides, Fungicides	Pesticides, Fungicides
	How to control	Plants that are attacked by pests are sprayed with pesticides/fungicides with a hand sprayer in the opposite direction to the wind	Plants that are attacked by pests are sprayed with pesticides/fungicides with a hand sprayer in the opposite direction to the wind
	Control Time	When the plants are 15 days old, 22 days old, 30 days old, and they will be harvesting	When the plants are 15 days old, 22 days old, 30 days old, and they will be harvesting
	Coaching	There is intensive	The absence of

	coaching by growers and companies related to pest control and cultivation techniques	intensive coaching related to pest control and cultivation techniques

Source: Authors' survey in 2019

Cultivation practices between contract and non-contract farmers have been applied following standard operational procedures. The survey shows differences in some aspects of chilli cultivation practices. Differences in seed supply, contract farmers use seed varieties determined by partner companies. The seed given by the grower is the seed that has been selected and received Indofood's permission to be propagated, besides the seeds produced by the grower are guaranteed quality because they are monitored by the company. Giving seeds by the grower is done so that the quality of the red chili produced by contract farmers is by the standards set by the company. The Partner company also determines whether or not seeds are to be planted. Based on research Syukur et al. (2010), quality seeds from superior varieties are one of the factors that influence the success of production on red chili. According to Permadi & Kusandriani (2006), farmers use superior seeds and intensive cultivation systems, chili productivity can reach 12 tons ha (Rodrigues et al., 2010; Pott et al., 2020).

Land processing in contract farmers and non-contract farmers is done piracy then mounds are made and then contract farmers left the land 14 days after processing, while non-contract farmers are shorter, namely for 7 days after processing. This land management, known as zone land preparation or precision land preparation, is a system of developing extensive land management that is effective for loosening land that is lower than normal depth Chaudhary et al. (1985); Barbosa et al. (1989); Parker et al. (1989), increasing root depth of root density Chaudhary et al. (1985), increasing infiltration rates Mukhtar et al. (1985), increasing the availability of water for plants along with increasing root depth and increasing water storage (Trouse, 1983). Also added according to Intara et al. (2011) that the application of tillage combined with mulching showed good performance.

The provision of sufficient water is needed for plant growth and development because the chili through their roots tries to absorb enough water from the soil for their growth and development. The availability of groundwater for plants depends on the type of soil and ability of the plants to utilize existing water. Based on research by Intara et al. (2011), the provision of water through an irrigation system is the best way, Non-contract farmers not only use rainfed but also irrigation systems. Contract farmers use rainfed only but when entering the dry season contract farmers will use a drip irrigation system to irrigate crops (Marín et al., 2009; de la Mora et al., 2006).

Many contract farmers use higher quality pesticides compared to non-contract farmers. For POC fertilizer and seed farmers who contract with Indofood get help from growers, so that the quality is uniform and guaranteed. POC fertilizer application for red chili plantations is carried out by contract farmers with a dose of 80 ml per liter of water so that the red chili crop contract farmers experience

optimal growth. The fertilizer dosage given by farmers is by research conducted by Makmur & Magfirah (2018), that the growth of red chilies will be optimal in administering 50 ml and 80 ml POC fertilizer doses per liter of water.

Pest and disease control, both contract and non-contract farmers still use pesticides, herbicides, and fungicides. Based on Ameriana (2008) Farmers generally use synthetic pesticides for pest control because they are easy to do, effective, fast, easy to obtain, and relatively inexpensive. Contract farmers use chemicals with certain brands that are of higher quality compared to non-contract farmers. Contract farmers provide pesticides with doses that do not exceed the threshold to kill pests and diseases so that the pesticide residues do not exceed the threshold determined by the company. According to Ngowi et al. (2007), pesticide residues can pose a danger to consumers' health because the accumulation of residues will result in health problems that can occur in the long term.

Coaching for contract farmers is carried out intensely by growers, while non-contract farmers do not receive intense coaching. Guidance conducted by the grower is coaching in controlling pests and diseases, and coaching in terms of good cultivation by SOP (Standard Operational Procedure). According to Erfit (2011), with the guidance of farmers, the company hopes to improve farmers' knowledge and skills so that the commodities produced can meet the expected quality standards as specified in the SPK (Contract Agreement Letter), and technology transfer from partner companies to partner with farmers related to better crop management. In addition to coaching carried out by companies guiding farmer groups by farmers in collaboration with the government. Based on Erfit (2011), coaching in farmer groups is expected to help explore the potential, solve the problems of farmer members more effectively, facilitate access to information, markets, technology, capital, and other resources. Also, the formation of farmer groups can improve the ability of farmer groups to carry out their functions, increase the ability of members in developing agribusiness, strengthen groups to become strong and independent farmer organizations (Wong, 2021; Arnawa et al., 2019).

Comparison postharvest practice of contract farming farmers and non contract farming farmers

Table 2
Descriptive statistics: comparison between contract and non-contract farmers

No	Action	Activity	Contract Farmer	Non Contract Farmer
1	Harvest	Harvest Age	90 HST	110 HST
		people who harvest	by farmers	by farmers
		Harvest Volume	1,52 Ton	1,048 Ton
2	Post-harvest	Collection / transportation	Harvesting is done in the Grower ward	Middlemen who take the harvest from farmers
		Sorting	Sorting / choosing red chilies has been rotten, and not yet mature	farmers only separate the rot and not rot, red chili is not separated mature and not yet

			mature because all are sold
	Grading	No grading	No grading
	Treatment	No treatment	No treatment
	Storage	brought to the Indofood factory by the grower	brought to the market by middlemen

Source: Authors' survey in 2019

Postharvest practices are applied differently between contract farmers and non-contract farmers. Contracted farmers have a postharvest ward centered at a farmer's house. The quality of red chili from contract farmers must meet company requirements (PT. Indofood). The quality of red chili produced by uniform contract farmers is good condition, smooth, not rotten, and red. The quality of red chili in non-contracted farmers is not uniform because non-contract farmers sell their products to traditional markets or intermediaries that do not require certain quality standards. All red chilies will be taken by intermediaries except for the rotten ones at very low prices (Imorou, 2020; Widyantara & Sukaatmadja, 2019).

The impact of cultivation and post-harvest practices on contract farming on production and productivity

Table 3
Effect of contract farming on production and productivity: T Test results

Variable	Mean		t-stat	Std Error Difference	(Sig 2-tailed)
	Noncontract farmer	Contract farmer			
Production (Tonnes)	1,14	2,08	7,728	121,720	***.000
Produktivity (Tonnes/ha)	5,84	13,45	16,593	458,831	***.000

Source: Authors' survey in 2019
Note: ***Significant at 1 % level

Table 3 shows the characteristics of contract and non-contract farmers. There is a significant difference between contract and non-contract farmers at the 1% level: contract farmers show high production and productivity. Contracted farmers showed 61.6% higher yields compared to contractless farmers, and differed statistically significantly. Based on research, contract farmers have high production and productivity compared to non-contract farmers. Production and productivity of contract farmers are better because contract farmers have shown contracts with companies with higher product quality standards, and this makes contract farmers try harder while diligently caring for their crops so that they are by the standards demanded by the company. Similar results were found in agricultural contract studies such as Miyata et al. (2009), in China and Sokchea & Richard (2015), in Cambodia. Based on research, apple farmers in China experienced an increase in productivity by an average of 47,966 kg/ha compared to non-contracted farmers, and rice farmers in Cambodia experienced an increase in productivity by an average of 1.65 MT/ha compared to non-contractor farmers.

Many factors cause contract farmer production to be higher than noncontract farmers. Guidance is carried out by the company, and growers become a factor that makes the production and productivity of contract farmers high. Guidance enables farmers to apply cultivation according to SOP (Standard Operating Procedure). This is the same as the results of research from Erfit (2011), where partner companies provide technical assistance to partner farmers, technical assistance is carried out primarily in connection with various matters relating to land management and crop management which is partnered so that the resulting commodity can meet the expected quality standards according to those specified in the SPK (Bellemare, 2012; Bolwig et al., 2009).

The next factor is that the farm costs incurred by contract farmers are more expensive than non-contract farmers. Contract farmers invest a lot in cultivation because contract farmers must meet the total quota requested by the company with the quality specified in the SPK. Contract farmers spend a lot of money on fertilizers and pest control. Fertilizers used by contract farmers are high-quality fertilizers, while the pesticides used in pest control are pesticides with low doses but are very effective at killing pests. Similar results also occurred in the Sokchea & Richard (2015), in Cambodia, where contract farmers spent the highest agricultural costs compared to non-contracted farmers. Contract farmers get price certainty, and market access from the company, so contract farmers do not question the agricultural costs incurred because the results obtained are better (Filippova et al., 2021; Trofimov et al., 2021).

Conclusion

Contract farming on chili commodity has an postive impact on cultivation and postharvest practices. Produced chili meets the quality standards based on the agreement with the grower and company. Cultivation and post-harvest practices in contract farming increase the chili farm production and productivity. In contract farming, cultivation and post-harvest practices done by farmers are controlled by growers as representatives of the company. Tight control over the products produced by farmers generates not only for the better quality, but also the increase chili farm productivity. This study states that the cultivation practices and post-harvest practices on contract farmers are better in quality, as well as in quantity compared to non-contract farmers. Cantract farming is recomended to apply other agricultural commodities, specially for high risk commidity which has hug price fluctuation, high quality variation, and susceptible to climate changes.

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