Improvement of the chili technology package for multiple production of red chili in Karo District

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Abstract. The latest IAARD’s innovation for stepping up in the productivity of red chilies is called the Double Fold Production (Proliga). Before this program started to be transferred, it was necessary to determine the existing features of the red chili cultivation technology at the study site of the Proliga program. The purpose of this study was to analyze the existing cultivation technology performance, productivity, constraints and to analyze red chili farming, and to formulate a strategy to improve the cultivation technology innovation package. The research was carried out through a structured survey of red chili farmers in Bukit Village, Karo Regency from August 2017 to February 2018. The results of the study found that the productivity of red chili in Karo District was stagnant for a decade, namely 8.28 t / ha. Area per household was 0.06-0.15 ha. The average B/C value = 0.13. This study concludes that the main strategy to achieve a jump in productivity (from 8.25 t / ha to ≥ 16.5 t / ha) through the application of Proliga technology innovation in Karo District was the use of healthy seeds, site-specific fertilization and Bemisia border installation since the beginning of planting.

1. Introduction
Red chili farming is more profitable than cayenne pepper in North Sumatra [1]. The productivity of red chilies in North Sumatra over the past ten years is 10.11 t / ha at the provincial level [2], 8.28 t / ha at the Karo District level and 7.96 t / ha at the Dolat Rayat Sub-district level [3]. It was increased of 2 - 4% per year on average. Efforts to increase productivity or production per unit area of farming activities are an important issue in agricultural development [4].

There is still a high gap between real productivity at the farm level and potential productivity of red chilies which can reach 12-15 t / ha [5-8], indicating that there are still various limiting factors. Among them are the lack of knowledge / mastery of technology at the farmer level, the low level of technology adoption [4], limited capital ownership, and the risk of crop failure due to pest attacks [4, 9-11]. A high productivity gap can also occur due to narrow land ownership (<0.5 ha), as well as a scattered business pattern that causes heterogeneity in cultivation patterns and the quality of the products produced [12]. In relation to efforts to increase productivity, one way that can be done is through increasing the use / application of science and technology (IPTEK) [13]. Through the proper application of science and technology, science and technology are able to produce red chili products that are competitive, efficient,
of quality (clean from harmful contaminants, attractive appearance, and the physical condition of smooth / flawless fruit), healthy, and safe for consumption [14], and able to meet the increasing market demand.

Until now the Agricultural Research and Development Agency through its commodity centers has played a role in formulating various red chili cultivation technologies, starting from seeds [15-18], chili breeding [19, 20], technical culture [21-24], controlling plant pests (OPT) [25-29], and postharvest handling. The latest technology produced by the Agricultural Research and Development Agency to increase the production of red chilies and shallots is called Proliga (double fold production). The Proliga program is one of the alternative innovations for a leap in productivity by improving technology. This technology will be delivered to users, namely farmers in the Karo district of North Sumatra. Before this technology is delivered to farmers, it is necessary to formulate technological improvements that need to be made from the existing technology of farmers, so that it is easily adopted by local farmers.

The purpose of this study was to formulate a strategy for adjusting the cultivation technology package to increase production. Multiple production of agricultural research and development agencies from the observations of the existing performance of farmer cultivation technology, and the production achievements that have been achieved by farmers in Karo Regency.

2. Methodology
This study was carried out before planting began for the implementation of a study on the technology of double-fold red chili production, from August to December 2017. The location was in the North Sumatra red chili production center, namely Karo Regency, Dolat Rayat Sub-district, Bukit Village. Primary data were collected through interviews and focus group discussions (FGD) with farmer groups and monitoring around production centers. The number of respondent farmers was 30. Respondents were chosen deliberately (purposive sampling), namely members of farmer groups, prospective farmers who will participate in the study of planting red chilies using Proliga technology or Multiple Production.

The data analysis of the observations was carried out descriptively, both on the aspects of cultivation, yield, marketing, and financial analysis of farming. To determine the financial feasibility of each fruit marketing actor, an analysis of the balance of revenue and costs (R/C ratio) and the analysis of the balance of benefits and costs (B/C ratio) were carried out using following methods.

B/C Ratio = (total revenue - total expenditure): total expenditure. Farming feasibility analysis using parameter B/C follows the method of Ruskandar et al. [30]. Red chilli farming using Proliga technology of existing farmers was analyzed financially using B/C [31-33]:

\[ B/C = \frac{HP \times P}{BP} \]  

Information:
HP = Production price (Rp / kg);
P = Production (kg / ha);
BP = Production costs (Rp / ha);
B/C = Benefit / Cost

3. Results and discussion
3.1. Characteristics of the assessment site
Bukit Village, Dolat Rayat District, Karo Regency is located at an altitude of 1300 m above sea level. The distance from the village to the sub-district is approximately 4 km, and the distance to Medan, the provincial capital, is 1.5 - 2 hours by public vehicle. The site has well road access for 4-wheeled vehicles and the area is a production center of horticulture. The land of the farming community in Bukit village, Dolat Rayat sub-district is categorized as dry land, with an average ownership of 0.5 (range 0.25 - 2 ha). The dry land owned by farmers is generally flat (80%). The water source for planting comes from collecting rain water with a small tub that functions like a small reservoir measuring 2 x 1.5 m² or 2 x 2 rain water. When the dry season arrives, water availability difficulties arise. This is overcome by buying water from a water seller.
The results of soil analysis using the Dry Soil Test Kit (PUTK) showed that the soil nutrient content for P and K was low, and organic C was low. To improve soil fertility, it is necessary to provide additional nutrients with fertilizers ranging from 150-200 kg / ha, K₂O: 100-150 kg / ha, giving organic matter 10-30 tons / ha, Urea 150 - 300 kg / ha, without liming (table 1).

Table 1. Soil analysis results of Bukit Village in Karo Regency with the dry soil test kit.

| Soil nutrient content | Analysis results | Recommended improvements |
|-----------------------|------------------|--------------------------|
| Phosphor              | Low              | P₂O₅ 150 kg/ha every 3 months |
| Potassium             | Low              | K₂O : 100 kg every 3 months |
| C-organic             | Low              | Manure 10-15 t/ha every 6 months |
| Soil pH               | Moderate         | Without increase agriculture lime |

The pattern of land ownership in this village, apart from being owned by themselves (80%), some are borrowed to pay rent (10%), or borrow family land without being paid (10%) agricultural lime. The red chili cropping system in Karo Regency, generally is intercropping and intercropping. In the area of land where immature coffee is grown less than 6 months old, the cropping system is intercropping coffee and red chili. Most often (65%) overlapping tomato-chilies. The red chilies are planted next to the tomatoes after the tomatoes are producing. This intercropping is indeed a good result according to the research of Suwandi et al. [34]. When the tomato plants are old and no longer productive, the old tomato plants are removed by pulling the stems, only the chilli plants are in full bloom. Bamboo sticks, are still being used to stalk red chilies along with tomato ropes, tied to a used tomato bamboo sticks, which are still suitable to support the chilli plants. Bitter mustard greens are inserted near the flowering phase of the chilies, and harvested before the first red chilies harvested.

This chili farmer also grew vegetables such as tomatoes, broccoli, red chilies, cabbage, bitter vegetables, etc. Red chilies are planted by farmers intercropping with tomatoes (75%), bitter vegetables, and cabbage. Red chili farming area is between 500-1500 m². Most farmers planted an area of 1000 m² (52%). Such an area can also be found in Simalungun district, North Sumatra [1].

The chili fruit in this area is sold red chili (90%). There are also 10% of farmers who sell green chilies. There are special varieties for the production of green chilies that are sold in stores. No grading of red chilies was done. Chilies are sold in kilograms in transparent white plastic packages measuring 40 - 50 kg.

During harvest 1 to 6, the quality of the chilies was still good. Fruit size was ranged 10-15 cm long. The fruit will get smaller and become shorter and crooked at the end of the fruit resembling the letter J or the letter O as the yellow virus attacks increased. The vector was a whitefly or *Bemisia tabaci* pest which carries the virus from sick plants to healthy plants. The planting season of red chilies in Bukit village is late August to September, because it is the end of the dry season before the rainy season.

3.2. Characteristics of respondent farmers

To see the household profile of red chili farmers, an approach used was by looking at the age of the farmer, education, number of family members, the scale of the business (table 2). Aspects that affect the skills of farmers in managing their farms include age, education, status and number of family members.

Most of the respondent farmers (76%) are in the productive age range, that is, between 27-50 years, while from the education side, the number of respondents with high school and tertiary education is more (52%), compared to junior high and elementary schools. With this level of education, generally respondents can read and write, to get information and record information on their farming. These skills are needed when given leaflets containing technology dissemination [14], recording capital and revenues. Young age and high level of education allow farmers to be more dynamic and more receptive to new innovations. With these conditions, farmers are able to manage their farming optimally with the available physical exertion.
Table 2. Characteristics of chili farmers in Karo District, North Sumatra, 2017.

| No | Description                                      | Percentage of farmers (%) |
|----|--------------------------------------------------|---------------------------|
| 1  | Age of farmers                                   |                           |
|    | 27 - < 50 years                                  | 76                        |
|    | 50 - 59 years                                    | 19                        |
|    | > 60 years                                       | 5                         |
| 2  | Level of education                               |                           |
|    | Primary school                                   | 22                        |
|    | Junior high school                               | 27                        |
|    | High school                                      | 43                        |
|    | University                                       | 8                         |
| 3  | Number of family dependents                      |                           |
|    | < 3 persons                                      | 25                        |
|    | 3 – 6 persons                                    | 50                        |
|    | > 6 persons                                      | 25                        |
| 4  | Type of work and source of income                |                           |
|    | farming                                          | 95                        |
|    | Non farming                                      | 5                         |
| 5  | Number of farmers based on area scale            |                           |
|    | 0.1 -0.4 ha                                      | 14                        |
|    | 0.5 – 1 ha                                       | 54                        |
|    | > 1 ha                                           | 31                        |

Source: Processed primary data, 2017.

Respondents’ experience in chili farming was still 1-2 years old (34%), the rest was over 10 years old (66%). Chili farming contributes to the income of the Karo community in Bukit Village. Chili farming is cultivated intensively, with harvest ages ranging from 4.5 to 5 months. Before producing, the farmers earn money from intercropping chilies with short-lived vegetables such as bitter vegetables, lettuce, cabbage. Chili farming requires a lot of labor and is intensive.

The jobs that require the most labor are during land preparation, and planting and harvesting red chilies. In Karo District, casual daily labor is easy to obtain, because many workers come from outside the city offering services to work as farm laborers in horticultural farming. So socially and economically, chili farming is not only beneficial for the business actors (farmers) concerned but also provides benefits for other people (the surrounding community), which can create new job opportunities.

3.3. Chili cultivation performance in Bukit Village, Dolat Rayat Sub-district, Karo Regency

3.3.1. Cultivated varieties of red chilies. The red chili varieties used by farmers were local varieties (90%) while the rest (10%) were varieties purchased from input production shops. The Rampati hybrid chili variety is the most popular in Karo District. Local varieties are usually adaptive, and they are cheap. The varieties used by farmers after being identified were local varieties with Green temper and Purple temper. According to Basuki [36], on the one hand the use of imported variety seeds needs to be limited because it wastes foreign exchange and on the other hand causes farmers to depend on imported variety seeds.

3.3.2. Source of red chili seeds. The red chili seeds used by the majority of farmers are root seeds (90%). The seeds from neighbouring farmers from the previous red chilli crop physiologically ripe were selected. The problem is that farmers have not mastered the technology and process of seedlings properly, so that the seeds produced carry pathogens, which result in suboptimal productivity [34]. Farmers on the island of Java are doing the same thing.
Local variety seeds are sown in open land, on the provided beds given manure and chemical fertilizers, sprayed with pesticides once a week. At the age of 6 weeks the seedlings are removed and planted into the prepared land. Usually the seeds will experience long stress if the watering is not enough. That is the reason farmers plant red chilies in September because the soil is already raining damp. The percentage of dead plants is low. These seeds are also available for sale per bunch at farmers’ traditional markets. Fill 1 bunch of 30 to 50 seeds measuring 10-15 cm.

Seedlings like this are usually infected with a yellow virus which is transmitted by the vector *Bemisia tabaci* or whitefly. Bemisia pests easily transmit curly disease viruses to healthy pink chili plant seeds. Plants from seeds like this will immediately curl and stunt like shown in figure 1.

![Figure 1. Open chili nursery by farmers that was easily infected by the whitefly vector (A), Farmers' red chili plants were attacked by yellow virus, stunted, low production, short time productive life, only four harvests (B).](image)

The nursery is carried out by chili seed traders using banana leaves. Banana leaves are formed into a circle, 5 cm high, 2 cm in diameter. Seeds like this when transplanting, the stress period of the plant is only brief. The age of the chili seeds that are sold are various levels. The price per seed is IDR350. Seeds like this are easily obtained at the nursery farm, which is 7 - 8 km from the location. Smooth transportation to the location of purchasing red chili seeds like that. Observation in the field of nets used by the nursery is still not tight enough so that whitefly can enter, preferably using a smaller mesh hole size.

In addition to providing direct benefits in the form of increased farmer income and employment, chili farming also provides indirect benefits. The indirect benefit is in the form of multiplier effect (chain effect) from the chili cultivation. Chili farming creates healthy nurseries, in addition to agricultural production facilities and marketing of agricultural products, which have enormous benefits for the macro economy [13].

3.3.3. *Plants blocker (Border plant).* Farmers do not plant whitefly blocking plants. This happens because they do not know the transmission of curly disease caused by whitefly vector. Farmers in Karo district whose farms were formerly citrus plants did indeed plant hedgerows, namely *Hibiscus rosa sinensis*, with the aim of avoiding the theft of citrus fruits. Another fence is installing a plastic fence as high as the width of the plastic, which is 2 m when the chilies start producing and the price of chili is expensive. The purpose of cutting plastic fences is to prevent theft of chilies and windbreaks.

The red chilies in the highlands are harvested after 4.5 months from planting. This waiting period is relatively long to receive income for farmers. So the local wisdom of farmers is to plant intercropped red chilies with short-lived vegetable crops, such as bitter vegetables, cauliflower, and broccoli. The cropping pattern is by overlapping chilies with tomato plants. Plant the tomatoes first and then the red chilies. Planting red chilies is given a bamboo stake measuring 1.8 m, this is also what is used as a stake for red chili plants to support the wind. This chili-tomato cropping pattern has been studied by Suwandi et al. [34] and the results are very good, in terms of land use efficiency.
Land processing for planting red chilies is done manually using hoes. For the implementation of this farming activity, farmers add to their workforce using freelance daily labour. Tillage using a tractor is also available but very limited, usually on land that is not intercropped with other crops (25%). Karo farmers' local wisdom in managing land is very good, because it is very rare to find idle land in the village, everything is done intensively. The silver black plastic mulch used is 90 cm wide. The distance between the beds is 1.25 to 1.5 meters. This wide spacing allows farmers to freely move to plant other crops as intercropping or intercropping, before harvesting red chilies which are relatively long (4 to 5 months) can only be harvested if planted in the highlands, the number of plants per ha is 16,000 plants.

Before the beds are formed, the land is given manure ranging from 3 to 5 tons / ha, there are also 40 and 80 tons / ha of cow manure according to the amount according to household finances when planting.

3.3.4. Fertilization. Organic fertilizers provided by farmers are chicken manure (20%), and cow manure (80%). The amount of manure varied from 4 tons to 80 tons / ha. But on average, give 3 - 5 tonnes / ha of chicken manure or 10 tonnes / ha of cow manure, once only before being covered with mulch. The cost is calculated to be around IDR 6,800,000, -. The giving in high doses is carried out in stages by farmers who use seeds purchased from the nursery for healthy red chili plants that have a long life. Apart from that, it is given additional organic fertilizer from the sieved landfill waste or the residual palm waste that has been mixed which is sold at input production shops, which are 5 to 6 times more expensive. Organic fertilizers like this are only given 2 -3% of the amount of organic fertilizer that farmers give to their red chili plants.

Solid chemical fertilizers are applied to basic fertilizers with varying amounts, then applied with a cast system in red chili plants using mulch. All farmers use foliar fertilizers that are provided with pesticides. Sources of information on fertilization from input production stores and personal and family experiences. In plants without mulch the addition of fertilizer usually remains in solid form. The amount of chemical fertilizers given varies, the cost is calculated to reach IDR 10,400,000.

3.3.5. Plant maintenance. Watering at the beginning of transferring seeds to the field is rarely done, because there are other plants that protect the red chili plants to reduce evapotranspiration. Local knowledge of farmers like this is very good, because it saves the cost of production. Disposal of wild olive trees and the establishment is not too high so as not carried out by farmers

3.3.6. Pests and diseases. The problem of plant pests (OPT) faced by farmers in the cultivation of red chili is felt necessary by farmers. Pest and disease control using chemical pesticides regularly, 2 times a week, not using biological pesticides. Insecticides, fungicides, acaricides, foliar fertilizers are put together in a carrying tank, then sprayed. This practice is practiced not only for chili plants but for all other horticultural crops as well. Mixing various pesticides like this is not recommended because it can reduce the effectiveness of the pesticide.

3.3.7. Harvest and marketing of produce. Farmers are harvesting red chilies by picking the red chilies by hand. Usually 1 harvest worker is able to harvest 20 kg per day if the fruit is thick. Harvest chilies are done once a week. If the color of the fruit is red. Chili is sold to the district market or to the district market, which is available every day in a different location. Farmers do not grading chilies. All are put in a transparent white plastic package which is formed about 60 cm in height with a diameter of 1 m. Weighs ranging from 50- 70 kg. The first harvest until the sixth harvest, the quality of red chilies is good, straight and long. When a plant is attacked by a disease, the fruit will quickly decline in quality, becoming shorter and crooked like the letter J or closer to the letter O.

3.3.8. Productivity of farmers' red chilies. The average productivity of responder farmers is 3.5 to 6 tons per ha. From the median value and mode of productivity figures for respondents 4, 242 tonnes / ha. If you take into account the cultivation of red chili in Karo District, the efficiency needs to be improved. The activity of implementing a doubling of red chili peppers at this location has the potential to be very
successful. Participating farmers were excited to follow the efficient technique of the double-fold red chili production technology.

3.4. Main factors causing the low productivity of chili peppers in Bukit village farmers
The main problem in red chili cultivation in Bukit village, Dolat Rayat District, Karo Regency, is chili curl disease. The red chilies they planted were sometimes attacked by 100 percent curl so that the harvest period became short. Farmers do not know the cause of curly disease. To overcome this, they sprayed chemical pesticides intensively, mixing various brands at once. However, their efforts have not been successful. Chili farmers’ nurseries that have been done openly, without shade and without mosquito nets, near their homes or in their fields if water is available in the fields (96%). Only 4% buy seedlings in wooden trays from closed nurseries, at a price of IDR 350 per stem not including transport costs. Such nurseries facilitate the spread of curl disease because the area is endemic to curly disease caused by viruses. This virus is spread by whitefly (Bemisia tabaci). Chili plant seeds that are still healthy, in conditions with open nurseries, are very susceptible to jaundice. Whitefly easily transfers the virus from diseased plants to healthy plants. Symptoms of a virus attack were not visible during the nursery. But when the chili plants have been transplanted the symptoms are getting clearer. Therefore, in this study a healthy nursery will be carried out in the Bemisia tight room.

Farmers do not plant whitefly (Bemisia tabaci) as a barrier plant in the field. The installation of a white transparent plastic fence was done by farmers (5%). According to them, the purpose of installing transparent white plastic is for wind breaking. The technology of whitefly control using corn border plants planted 4 rows before planting will be carried out in this proliga study. Red chili farming were small area. Each stage of planting chilies covers an area of 1000-2000 chilli plants or about 1000 to 1500 square meters.

Natural resources such as watering red chilies are not available naturally. When dry season, farmers buy water for the nursery and spray for pesticide. The basic need at the farmer level is the prevention of yellow curl disease by conducting healthy seedlings in the strict nursery of Bemisia tabaci or whitefly.

3.5. Red chili farming analysis
The number of chili plants planted is generally 1000-2000 plants or an area of about 1000 to 1500 square meters. The average land ownership area is 0.5 ha, farmers are still farming other commodities, such as green beans, strawberries, cabbage, Chinese cabbage, flower cabbage, tomatoes etc. The average productivity of red chili pepper farmers is 4,242 kg / ha. This result is very low compared to North Sumatra’s chili province, but the result is not much different from that obtained by [16], namely 4.5 t/ha. The value of B / C can still be increased by increasing productivity through the application of the Multiple Fold Production Technology Innovation (Proliga) which targets a multiple of this yield, around 20 t / ha. Apart from that, it is necessary to support the work relationship system and other institutions (table 3).

Table 3. Analysis of red chili farming in Bukit Village, Dolatrayat, Karo Regency, December 2017.

| Description | Total ( IDR) |
|-------------|-------------|
| A. Wage cost (Rp 65,000/ person per day) | |
| Wages land preparation to planting | 10,000,750 |
| Wages for maintenances plant | 30,550,000 |
| Wages for harvest of red chilies | 7,953,750 |
| B. Cost of Production Facilities | |
| Seeds : local variety : Temper | 88,000 |
| Manure | 6,800,000 |
| Bamboo | 5,000,000 |
| Inorganic fertilizer | 10,400,000 |
| Pesticides | 15,000,000 |
Mulch, drum, plastic sheeting 3,000,000

C. Land rent per year 5,000,000
Total cost of Red chili production 93,792,500
The costs per kg for producing red chilies by farmers 22,110

Revenue
Production per ha (4,242 kg x IDR 25,000) 106,050,000
Benefit IDR/ha 12,257,500
B/C 0.13
Benefit for area : 1,500 m in 6 months 1,838,625
Farmer's income / month from red chilies only 306,438

Source: Processed data.

3.6. Institutional
The price of red chili is very elastic and there is no institutional means of production for agricultural product processing traders in the village or subdistrict. At the time before this activity started, the price of red chilies was very low, ranging from IDR 5,000 - IDR 8,000 per kg. So that farmers suffer a lot of losses. For this reason, it is suggested that a home industry for post-harvest processing of red chilies such as drying chilies, chili sauce, products like this will be more resistant to storage. Information on technology was obtained by some farmers from extension workers. The largest imports of dried chilies are supplied from India to Indonesia.

There is no financial institution at the village level, however, because the distance from the village to the sub-district capital is relatively close (15-25 minutes by motorbike), and many public vehicles are crossed, it is relatively easy to go to financial institutions such as BRI or BPDSU. There are also farmers who have used credit from banks and credit unions (CU) in the area, apart from borrowing family capital.

3.7. Technological refinement formulas with Site-specific multiple production technologies
To increase the productivity of red chilies based on the technological performance of farmers in Bukit Village, Dolat Rayat District, Karo Regency, suggestions for alternative improvements to farmer technology through multi-fold production activities that are tailored to specific locations is shown in table 4. Productivity isn't the only factor driving technology adoption. Two other factors that are taken into consideration are the availability of working capital and the age at which the plants are harvested [33].

Table 4. Alternative improvements using a multiple fold production technology of red chili

| No | Aspect/s           | Technology components multiple fold production of red chili                                                                 |
|----|-------------------|--------------------------------------------------------------------------------------------------------------------------|
| 1  | Variety           | Local variety: temper ungu and temper hijau still used because it is adaptive and the price is cheap and easy to obtain |
| 2  | Nursery           | Needs to be improved: The nursery is done in a nursery that is strictly infested by Bemisia pests and immunized with the leaves of the pagoda flower plant Clerodendrum japonicum (Thunb.) found in the village. |
| 3  | Soil cultivation method | No need to be improved: farmers used to do it: perfect processing, made beds, using black silver plastic mulch, size 90 cm |
4. Silver plastic mulch  Farmers used to do it: Silver plastic mulch will be used for thrips pest control, and weed control in red chilies

5. Border plant before planting chili  Needs to be improved: Plant 4 rows of maize 1.5 months before transplanting red chilies, to prevent the arrival of whitefly vectors that transmit curly disease

6. Cropping pattern  Good local wisdom of farmers. Farmers are familiar: Overlapping with bitter mustard vegetables, red chilies

7. Method and planting system  Some farmers need improvement: Double rows of red chilies, spacing between rows, 0.5 m spacing between beds 1.5 m

8. Fertilization  Some farmers need improvement: manure, 20 tons / ha, chemical fertilizers, based on soil analysis, supplementary fertilizers are given by cast every 14 days. P fertilizer is given every 3 months. Fertilizer is also carried out when the plant sprouts are stagnant, but the plant's condition is still healthy

9. Maintenance of plants  It needs improvement that is environmentally sound and does not mix many types of pesticides in spraying pesticides. Installation of bamboo poles as a stake to support the plants Using yellow green glue, mouse glue, and yellow trap. Weeding is done before fertilizing. Organic herbicide treatment with plants that are around

10. Harvest and post-harvest  Farmers were doing well. Harvesting is carried out starting at the age of 120 days after planting (DAP), when the red fruit is sold fresh

4. Conclusion
- Red chili cultivation technology in Bukit Village, Dolat Rayat District, Karo District requires high production costs. The production cost of red chilies per kg is IDR 22,110. Farmers will be lucky if the selling price is above this price. Production per ha ranges from 4,242 kg.
- When the selling price is IDR 25,000 per kg, the B / C value of red chili peppers in the village of Bukit, Karo is 0.13. The value of B / C can still be increased by increasing production through the application of technological innovations
- Improvements that need to be done are only in healthy nurseries, applying fertilizers according to plant needs, planting border plants or barriers to the entry of Bemisia tabaci into the red chili planting area, methods of using pesticides that are environmentally friendly and cost-effective
- Simple post-harvest processing of red chilies is needed by farmers when the price of red chili is very cheap. Technology in the form of drying or institutions that can accommodate fresh red chilies when production is high

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