Effect of Planting Corn Harvest Cattle (TJPS) on sustainable integrated farming system in the Village of Raknamo West Kupang Subdistrict of Kupang Regency, East Nusa Tenggara

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Abstract. The aim of this study is to show community livelihood changes through the improvement of corn and cattle by application of “Planting Corn Harvest Cattle” (TJPS). TJPS is not literally meant that planting corn will that produced cattle, however it is a “tagline” to encourage farmers in the East Nusa Tenggara (NTT) that by improving corn production will give extra cash to buy cattle. The method was a survey involving 50 farmers, collecting primary and secondary data. The productivity of corn in NTT in 2018 was 2.52 ton/ha, while at National level was 5.24 ton/ha. Survey indicated that before TJPS, farmers in Raknamo village produced only 27.9 ton per one planting season, while at TJPS farmers produced 82.1 ton per one planting season, or it almost tripled. For cattle ownership, Raknamo farmers started with no cattle and now own 41 head of cattle. The use of corn cobs mixing with leaf of Tarramba Leucaena give DWG of 0.3 to 0.5 kg/hd/day. Thus it is concluded that TJPS would be an excellent entry door into a sustainable integrated farming system of corn and cattle in the dry land and climate of NTT.

1. Introduction
East Nusa Tenggara (NTT) agro ecologically included in Dry Land with Dry Climate (LKIK) region or semi-arid. The main characteristic of this region is that the annual amount of precipitation (rain) is lower than the amount of evaporation and thus experiences water deficit. NTT province has 3-4 wet months (December/January to March/April), and 8-9 dry months (April to November/December), with some of the region received 900 to 1500 mm or rain/year.

Farming systems of NTT thus counted as Dry land with dry climate farming, having around 3.35 million hectares where only about 34% of the dry land being able to be cultivated by the community. Potential area of the dry land to be cultivated is about 2.99 million hectares located in the low land, and around 234,446 thousand hectares located in the high altitude [1]. The dominant food crops cultivated by the family for their food security included: dry land rice, cassava, sweet potato, several peas and beans, and several pumpkins.

Corn is one of cereal commodities with strategic role and have opportunities to be developed with its role as the main source of carbohydrate after rice. Statistical Institute indicated the production of 809,803 tons of dry grain obtained from areas of 313,150 hectares with an average production of 2.586 tons per hectare [2]. Compared to 2006, corn production increased 17.63% and harvest area increased 18.03%, though productivity decreased by 0.35%. In the last decade corn production in NTT tend to be
fluctuated with an average of 4.04 growth per year. The productivity of corn in NTT only 2.5 tons/ha compared to NTB province reaching 6.7 tons/ha [3]. Corn plays as an icon food crop for NTT community, and relatively more beneficial than other dry land food crops, and thus attracts higher interest to farmers to cultivate.

Areas with less fertile land for food crops (usually grasslands) are more suitable for livestock, such as Sumba, Flores and Timor islands. Cattle are important as personal and social statues in NTT community. Cattle population in 2018 was 1,007,608 head [3], distributed to all Districts and sub-districts in NTT.

Corn and cattle can be considered as compulsory commodities to be secured and developed, and will lift the social statues of the community, when possess many hectares of corn and number of cattle. Corn stover, has high potential to be used as ruminant animals feed such as cattle, goats and sheep, as fiber source. Corn by products consisted of dry tem and leaves (hay), and cobs, which can be important feed source for livestock, when grass is limited, especially during the dry season [4, 5, 6, 7, 8, 9]. The aim of this research is to demonstrate changing in farming patterns in the community by the introduction and application of Program “Tanam Jagung Panen Sapi (TJPS)” or “Planting Corn Harvest Cattle”.

2. Materials and methods
Method used in the study was survey method, with simple random sampling. This method was applied on 50 respondent farmers participating on TJPS, at Raknamo village of East Kupang District. Data obtained were descriptively analyzed. Data consisted of primary and secondary data. Primary data included information on farming land as the research object, such as size of planting area, size of harvest area, and corn by product that can be achieved. Besides that, primary data can be obtained through interviews with farmers using prepared questionnaire. Secondary data collected includes size of farm land, production, corn productivity, and number of cattle obtained from livestock services and related institutes in time series, and number of farmer groups in the research area.

3. Results and discussion
3.1. What is TJPS
TJPS farming pattern is a management tagline farming to encourage farmers that through the increase of corn production farmers can sell the extra increase to buy cattle, in a relatively short time. In TJPS management farmer with 1 ha of land is expected to produce at least 5 ton grain corn/ha. From this production, 1 ton will be stored for daily meals and the remain 4 tons to be sold, as capital to buy cattle and savings. Assuming that if 1 kg of corn is valued at IDR3,200.-/kg, farmers may obtain IDR12.8 millions, which can buy at least 2 head of feeder cattle. This innovation in short of corn life (Quick win) of 3 months may change the ownership farmer status of the cattle becomes its own. Thus this managements is called “Tanam Jagung Panen Sapi” or Planting Corn Harvest Cattle. TJPS management in short time has capacity for meeting the basic needs of farmers for food security, while able to restore farmer status to “owner” of the cattle. In general the aim of optimization through TJPS is to be able to improve corn production and to reach the cattle “owner” status and to make use of corn by product as livestock feed.

3.2. Performance and productivity of corn farming
For NTT community, planting corn is part of the culture where corn is the staple food, where almost all community cultivate corn. Even NTT province is one of corn producer in Indonesia. Productivity of corn in NTT was 2.52 t/ha, while at national level the productivity was 5.24 t/ha. Thus there is opportunity to increase, as research data at BPPTP NTT indicated a productivity of 4.4 to 6.7 t/ha using Lamuru variety can be achieved. The low productivity at farmer level may be related to the lack of technology application including lack of using improved corn varieties, fertilizer, control of pest and diseases and planting without proper planting distance standard. Survey results indicated low usage of improved varieties (74% using local variety) and only 26% of New Improved Variety (VUB). At the
introduction of TJPS, the use of VUB increased to 88%, and only 12% used local variety. The VUB Lamuru was suitable for NTT as it tolerant of drought, meeting the taste of farmers, tolerant of storage pests. Productivity of 5.5 ton/ha at optimal condition. Meeting the preferences of farmers because of its tolerance of drought, and good at storage, considering NTT farmers in general store corn for 1 year for food and for planting seed.

Use of fertilizer has become part of corn farming practice. In general farmers already know type of fertilizer used, dosage, and application techniques. Amount of fertilizer used depends on soil fertility and stage of plant growth. Survey results indicated that 78% of TJPS farmers conducted 2 times fertilizer applications and only 22% conducted 1 application. Insects attacking corn includes stem borer, cutter peeler, and storage insect. While usual diseases may include downy mildew, leaf blight, leaf rust, cob rot etc. While weeds may consist of nut grass, broad leaf weeds (purslane, wild spinach). Control of pest and diseases conducted by 100% of farmers using chemical, as quick results obtained in the field. Table 1 presents the performances of TJPS farming pattern.

| No | Description                              | Before TJPS (%) | After TJPS (%) |
|----|------------------------------------------|-----------------|----------------|
| 1  | Soil cultivation :                       |                 |                |
|    | Manual                                   | 98              | 88             |
|    | Machine                                  | 2               | 12             |
| 2  | Varieties :                              |                 |                |
|    | Local                                    | 74              | 12             |
|    | VUB                                      | 26              | 88             |
| 3  | Planting Pattern:                        |                 |                |
|    | Rows                                     | 4               | 26             |
|    | Random (Conventional)                    | 96              | -              |
|    | Double track (DT)                        | -               | 74             |
| 4  | Fertilizer :                             |                 |                |
|    | No fertilizer                            | 94              | -              |
|    | 1 time fertilizer                        | 6               | 22             |
|    | 2 times fertilizer                       | -               | 78             |
| 5  | Pest and Disease Control:                |                 |                |
|    | No Chemical                              | 32              | -              |
|    | Herbal                                   | 56              | -              |
|    | Chemical                                 | 12              | 100            |
| 6  | Harvest :                                |                 |                |
|    | Manual                                   | 100             | 90             |
|    | Machine                                  | -               | 10             |

Source: Primary data, 2020.

Planting arrangements before TJPS in general conducted as random at 96%. Planting arrangements after TJPS using the Double Track of 74%. Double Track (DT) method aimed at managing the growth space for corn to avoid nutrition competition, gas (O₂ dan CO₂) and radiation between plants in one hole. This planting arrangement in fact increased plant population of 7%, become 71,000 plants/ha (20 x 40 cm; 1 seed/hole) compared with that of conventional rows (80 x 40 cm (2 seeds/hole) at 66,000 plants/ha. This method is called Double Track (DT) and has been widely implemented in participating Districts in NTT. This method proved to increase productivity up to 6.38 tons/ha compared with that of the conventional one at 3.2 tons/ha [10]. Survey results indicated application up to 94% of DT method, and rows method only 6%. Based on data collected corn productivity can be seen in table 2.
### Table 2. Production and productivity of corn.

| No | Description          | Before TJPS | After TJPS |
|----|----------------------|-------------|------------|
| 1  | Corn production (Kg) | 27,915      | 82,137     |
| 2  | To be sold (Kg)     | 2,950       | 66,787     |
| 3  | For food (Kg)       | 17,790      | 18,320.3   |

*Source: Primary data, 2020.*

Corn production before TJPS only up to 27,915 kg or farmer average of 558.30 kg/ha, compared to after TJPS, and increased three times as much as 82,137 kg or average of 1,642.74 kg/farmer. Before TJPS only sold 2,950 kg, while after TJPS farmers sold 66,787 kg or 1,335.74 kg/farmer. Similarly, the average consumption of 17,790 kg before TJPS, while after TJPS increased to 18,320.3 kg or 366.41 kg/farmer.

### 3.3. Cattle purchased

According to tagline constructed at TJPS, is to obtained cattle from the selling of extra corn production. To gain farmer trust on TJPS require proper preparation. Farmers need to properly understand for improved technology in cattle raising through field practices. Survey indicated that from TJPS approach farmers were now able to purchase 41 head of cattle. In general farmers purchased female cattle ready for breeding, though there are some farmers buying male cattle for fattening.

### 3.4. Use of corn and cattle waste

In general, farmers in NTT are not used to using corn by product (dry stem and leaf, cobs and cobs’ skin) to feed cattle, thus a lot of these materials were just wasted. This can pollute the environment and not good for community health. TJPS program encourage farmers to make use of the by product in zero waste approach. Results of feeding 4 male cattle with the mix of grinding of corn cobs and Tarramba leaf at IP2TP Lili research station can be seen in the following table (table 3).

### Table 3. Data cattle feeding based on corn cobs.

| No | Description | Body weight (Kg) |
|----|-------------|------------------|
|    |             | Week 1 | Week 2 | Week 3 | Week 4 |
| 1  | Cattle A    | 219    | 219    | 215    | 228    |
| 2  | Cattle B    | 187    | 198    | 192    | 201    |
| 3  | Cattle C    | 227    | 216    | 231    | 240    |
| 4  | Cattle D    | 202    | 205    | 204    | 216    |

*Source: Primary data, 2020.*

Cattle weighing data at 4 week feeding, presented in table 3, indicated that feed consisted of 30% corn cob and 70% Tarramba Leucaena leaf, resulted in significant body weight increase. Although in the two weeks of feeding animal body weight fluctuated, adapting to the feed offered, the last weighing showed better improvement. This simple descriptive experiment demonstrated that corn cob as by product of corn may clearly be useful as cattle feed, especially as fiber source, and when mixed with Leucaena leaf easily obtained locally makes a good feed material. This mixed feed contained approximately 14% of crude protein, suitable to cattle need for a proper growth and body weight gain.
Table 4. Feed intake data.

| Week- | Description | Feeding | Average |
|-------|-------------|---------|---------|
|       |             | Cattle A | Cattle B | Cattle C | Cattle D |       |
| I     | Feed        | 7        | 6        | 7        | 6.5      | 6.63  |
|       | Left        | 2.44     | 1.96     | 2.28     | 2.82     | 2.38  |
|       | Intake      | 4.56     | 4.04     | 4.72     | 3.68     | 4.25  |
| II    | Feed        | 7        | 6        | 7        | 6.5      | 6.63  |
|       | Left        | 1.94     | 0.68     | 2.74     | 2.16     | 1.88  |
|       | Intake      | 5.06     | 5.32     | 4.26     | 4.34     | 4.75  |
| III   | Feed        | 7        | 6        | 7        | 6.5      | 6.63  |
|       | Left        | 2.9      | 1.5      | 3.04     | 3.42     | 2.72  |
|       | Intake      | 4.1      | 4.5      | 3.96     | 3.08     | 3.91  |
| IV    | Feed        | 7        | 6        | 7        | 6.5      | 6.63  |
|       | Left        | 1.06     | 0.36     | 0.9      | 1.72     | 1.01  |
|       | Intake      | 5.94     | 5.64     | 6.1      | 4.78     | 5.62  |

Source: Primary data, 2020

At first week up to the third week the left over feed remain quite high compared to the intake, while entering the fourth week, the left over become much less about an average of 1.01 kg and intake of 5.87 kg, resulted in better body weight gain (table 4).

4. Conclusion

The TJPS farming pattern approach has been proved to have a positive impact on NTT farming community, in term of corn production improvement and cattle ownership. The use of corn by product as cattle feed significantly improved the provision of cattle feed, especially during the dry season. TJPS approach has changed the old practices into new practices through proper farmers training and mentoring in the field. The TJPS farming pattern introduced an integrated Farming Systems Pattern approach (IFS), by integrating corn and cattle in a mutuality symbiosis relationship, which benefits each other.

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