ISSN- 2350-0530(O), ISSN- 2394-3629(P)
DOI: https://doi.org/10.29121/granthaalayah.v7.i6.2019.733

INTERNATIONAL JOURNAL OF RESEARCH – GRANTHAALAYAH
A knowledge Repository

Science

COST AND RETURN ANALYSIS OF SMALL-SCALE PRODUCTION OF *Brassica Napus L. Varchinensis* (PECHAY) USING DIFFERENT METHODS OF CULTIVATION

Madelyn Yruma [1], Eunice L. Lluz [1], [*2]
[1] College of Agriculture, Fisheries and Natural Resources
[2] University Research and Development Services, University of Eastern Philippines, University Town, Catarman, Northern Samar, Philippines 6400

Abstract

A Cost and return analysis of small scale production of *Brassica napus* L. *varchinensis* (Pechay) production using different methods of cultivation was evaluated based on the growth and yield performance of *Brassica napus* L. *varchinensis* (Pechay) from field trial. An experiment was undertaken involving four treatments with two methods of planting and two levels of plant density and layed out in Randomized Completely Block Design (RCBD) with replications. Results showed that the survival rate and growth of *Brassica napus* L. *varchinensis* (Pechay) based on the actual number of plants, transplanted plant with high density plants was significantly higher compared to other treatments indicating that transplanted Pechay at high density planting is favorable than other methods. The fresh weight of Pechay after 30 days of cultivation using direct seeding (T_1 and T_2) was significantly higher compared to T_3 and T_4. Partial cost and return analysis in direct seeded Pechay at high planting density were the most profitable while transplanting Pechay seedling at low density planting was the least profitable.

Keywords: *Brassica Napus* L. *Varchinensis* (Pechay); Cultivation; Small Scale Production; Randomized Completely Block Design.

Cite This Article: Madelyn Yruma, and Eunice L. Lluz. (2019). "COST AND RETURN ANALYSIS OF SMALL-SCALE PRODUCTION OF BRASSICA NAPUS L. VARCHINENSIS (PECHAY) USING DIFFERENT METHODS OF CULTIVATION." *International Journal of Research - Granthaalayah*, 7(6), 10-17. https://doi.org/10.29121/granthaalayah.v7.i6.2019.733.

1. Introduction

The agriculture sector is deemed unsustainable as shown by various analyses (Dela Cruz, 2006). The main focus of the current development agenda is feeding the ever-expanding population. It loses sight of the negative environment consequences it creates, particularly on soil health. Land use is optimized through technologies and management practices that fall short of requirements for sustainability. The current practice in agriculture is basically chemical-based farming that

ISSN- 2350-0530(O), ISSN- 2394-3629(P)
DOI: 10.5281/zenodo.3262105

makes a considerable contribution to the degradation of natural resources especially soils. Heavy application of fertilizers has polluted surface and ground water resources.

Several strategies to augment problems of food in security is to promote small-scale home-based agricultural production system. In fact, programs implemented by the Department of Agriculture (DA) and some non-government organizations such as PLAN Philippines have promoted home gardening in every community that aimed to produce enough vegetables food for every household. Similarly, beneficiaries of Pantawid Pangpamilyang Pilipino Program (4Ps) are also required to engage in home/community gardening as part of the requirements for the cash transfer conditions. With the extensive promotions of small-scale agricultural production, it is necessary to provide important information about the feasibility of this small-scale production system. Such information will help small-scale producers in identifying strategies that will improve the production system and productivity.

In Northern Samar, the cultivation of Pechay is very easy because it is adapted to wide range of climatic conditions. It can be grown in almost all parts of the Province and in the country as well anytime of the year. The area for production requires a good drainage during rainy days and enough water supplies during the dry season.

Pechay is cultivated in several ways in Northern Samar. Commonly adopted method includes direct sowing and seedling transplanted in pulverized plots and at different planting density. Several experiments have evaluated these methods of production in terms of yield/plant growth performance. However, there was no study conducted among these different cultivation technique involving the cost and return analysis. Therefore, there is a need to evaluate the cost and return analysis of different cultivation methods so that farmers will know and will be aware which method is best suitable in Northern Samar.

2. Materials and Methods

Experimental Design

The experiment was conducted following a Randomized Completely Block Design (RCBD) composed of 4 treatments combination with three replications. A total of twelve 1 x 3 m plots were used in this study. The treatments were composed of the combination of the 2 methods of planting and 2 plant density. **Factor A: Methods of Planting; (**1) direct seeding and (2) transplanted. **Factor B: Plant Density;** (1) close-distance planting with 208 plants/plot and (2) sparse planting with 48 plants/plot. The treatment combination were presented in Table 1.

Table 1: Treatment combinations.

Treatment	Factor A	Factor B
T_1	Direct seeding	Close-distance planting (70 plants/m^2)
T_2	Direct Seeding	Sparse planting (48 plants/m^2)
T_3	Transplanted	Close-distance planting (70 plants/m^2)
T_4	Transplanted	Sparse planting (48 plant/m^2)

ISSN- 2350-0530(O), ISSN- 2394-3629(P)
DOI: 10.5281/zenodo.3262105

Land Preparation and Field Lay Out

An experimental area measuring 6.5 x 9 meters was cleaned, plowed and harrowed thoroughly until soil was pulverized to ensure good land preparation and control of weeds. The entire area was divided into 3 sub plots measuring 1 x 5m each with alleyways of 40cm between plots and replications. Land to be planted should be prepared that is, it should be kept moist Pechay grows on the elevation of 60 cm above the sea level (Mercado, 2004).

Plant Establishment and Cultural Management

Seedling preparation, for transplanted seedlings treatments, the seeds were germinated in seed box and one week after germination, the pricking off the transplanting disturb the soil the roots and breaks some of the roots and many incurred poor recovery and poor growth of plants (Gardner, 2005). Two weeks after the germination, the seedlings were transplanted to the plots at a distance of 25cm x 25cm (T_4) and 12cm x 12cm (T_3) at one seedling per hill.

For direct seeded treatments, three seeds was uniformly sowed directly to the plot at a distance of 25cm x 25cm in low plant density plots (T_2) and at a distance of 12cm x 12cm in high density plots (T_1). Thinning was performed three weeks after sowing to attain the desired density per plot.

Fertilizer application, a fertilizer was applied to the plants by sidedress method. The mixture of the fertilizer is composed of the following: 72 grams urea and 1.56 kilograms of vermicompost / m^2 (plot). *Care and Management, r*egular weeding, watering/sprinkling water, proper cultivation, pest and diseases control was done whenever necessary. *Harvesting,* the plants were harvested 30/days after transplanting.

Data Gathered

1) **Average fresh weight (g) of plant/plot -** the average fresh weight of whole plants using 20 sample plants from the sampling area of each unit plot.
2) **Total fresh weight of plant/plot** - the total fresh weight of whole plants from the sampling area of each unit plot
3) **Average number and weight of marketable plant/plot -** the average number and weight of marketable plants per plot was obtained by sorting plants without damage from insect pest and diseases.
4) **Average number and weight of non-marketable plant/plot -** the average number and weight of non-marketable plants per plot are those plants remained after segregating the marketable plants.
5) **Plant density -** The total number of plants per unit per area.

Formula: $Plant\ density = \frac{number\ of\ plants\ at\ sampling}{sampling\ area\ (m^2)}$

Cost and Return Analysis

The cost and return analysis was conducted for each treatment using the data from the daily journal of operations. Several assumptions were used during the cost and return analysis. The financial viability indicator used was the return of investment (ROI).

Formula: $ROI = \frac{Net\ income}{total\ variable\ cost\ of\ production} \times 100$

ISSN- 2350-0530(O), ISSN- 2394-3629(P)
DOI: 10.5281/zenodo.3262105

Assumptions

1) Labor cost was calculated base in man hours/plot
2) The cost of the seedling tray was 10% of the acquisition cost from the assumption that these trays can be reuse for ten times before rendered scrap.
3) Income was calculated based on the sales of products at farm grate prices of marketable yield. Non-marketable products are considered to have zero value.
4) Fixed cost was not included in the computation of the production cost and the ROI. ROI was computed based on the variable cost only.
5) Net income was calculated based on total gross sales minus variable cost, excluding fixed cost.

3. Results and Discussion

Survival Rate and Growth of Pechay under different Methods and Densities of Planting

The survival rate and the actual number of plants per plot after 30 days of cultivation were presented in Table 2. The data showed significant interaction effect between the method of planting and plant density. Based on the actual number of plants, transplanted plant with high density plants was significant higher compared to other treatments. On the other hand, survival rate of T_2, T_3, and T_4 were significant higher compare with T_1. The survival rate of these treatments were about 65.87 to 73.61% as compared with T_1 have only 26.44%.

The results indicate that transplanted Pechay at high density planting is favorable than other method because of higher number of plants that could grow per unit area. Increasing the number of plants growing could result to high probability of increasing harvestable crops than those methods with very high mortality rate and low number of growing plants per unit area. This result affirmed that the most appropriate method of planting for Pechay is through seedling transplanting as compared to mustard and other vegetable crops. Based on actual observation, low survival and actual plant density in direct seeded Pechay is due to high incidence on mortality due less root anchorage and high weed competition. Whereas, transplanted Pechay seedlings have higher survival rate due to higher capability to compete with weeds and firm anchorage into the soil.

Table 2: Survival Rate and Actual Population of Pechay after 30 days of Cultivation

Treatments Combination	**Population** (no./plot)	**Survival Rate** (%)
T_1 - Direct Seeding Close-distance planting	55.00 b	26.44 b
T_2 - Direct Seeding - Sparse planting	33.68 b	70.14 a
T3 - Transplanted Close-distance planting	137.00 a	65.87 a
T4 - Transplanted - Sparse planting	35.00 b	73.61 a
P value		
Planting method	0.003**	0.007**
Plant spacing	0.000**	0.003**
Planting method X plant spacing	0.004**	0.016*

Means followed by the same letter (s) are not significant different for each other based on two-way ANOVA and DMRT at 5% level. ** is highly significant, * is significant

ISSN- 2350-0530(O), ISSN- 2394-3629(P)
DOI: 10.5281/zenodo.3262105

Yield of Pechay under different Methods and Densities of Planting

The average fresh weight of Pechay after 30 days of cultivation was presented in Table 3. The data shows that significant effect was observed due to methods of planting but not with plant density. The average weight of Pechay of T_1 and T_2 is highly significant compared to T_3 and T_4. The average weight of these treatments was 110.4g/plant and 101.6g/plant compared to T_3, T_4 which was 51.58g/plant and 62.00g/plant, respectively. According to McMullum (2005) that direct seeding of planting Pechay at 3 pound per acre with 20 cm planting distance produced higher yield performance compared to the transplanted sample. Higher average weight of Pechay from direct seeded plant could be attributed to its ability to early establishment without undergoing the mechanical and environmental stress due to transplanting.

Plants established from direct seeding could be able to develop earlier than transplanted seedlings and would result to faster growth and development provided that they will be protected from competition from weeds and from they attacked of pest and disease. In this experiment, both plots in directed seeded and transplanted Pechay are devoid of weeds such that those plants established by direct seeding was able to develop faster resulting to higher fresh weight yield. It should also be noted that in general, the number of plants in direct seeded plots are fewer compared to transplanted plants that resulted to less competition with nutrient and sunlight and consequently increased growth rate.

Table 3: Effect planting method on the average weight of Pechay after 30 days of cultivation

Treatments	**Average weight of Pechay (g)**
T_1 - Direct Seeding Close-distance planting	110.4 a
T_2 - Direct Seeding - Sparse planting	101.6 a
T_3 - Transplanted Close-distance planting	51.58 b
T_4 - Transplanted - Sparse planting	62.00 b
P value	
Planting method	0.003**
Plant spacing	0.94ns
Planting method X plant spacing	0.439ns

Means followed by the same letter (s) are not significant different for each other based on two-way ANOVA and DMRT at 5% level. ** is highly significant, ns is not significant

Productivity of Pechay Under Different Methods of Planting and Densities

Yield Components

The total yield per plot, marketable yield and non-marketable yield of Pechay under the different method of cultivation at 30 days was presented in Table 4. Results of ANOVA revealed that there were no significant differences in the total yield and marketable yield between different method of cultivation and planting density. Only the non-marketable yield had significant differences between treatments had occurred.

However, closer scrutiny of the data revealed that total yield per square meter was higher in T_1, T_2 and T_3 compared to T_4 by as much as 100%. Similarly, although the difference is not significant, the marketable yield in T_1 was the highest compared to the other treatments. The marketable yield

ISSN- 2350-0530(O), ISSN- 2394-3629(P)
DOI: 10.5281/zenodo.3262105

in T_2 and T_3 are almost the same but are higher than T_4. On the other hand, the non-marketable yield was significantly higher in T_3 than the rest of the treatments. Lowest weight of non-marketable yield was obtained in T_4. The weight of non-marketable harvest in T_3 was more than 50% of the total yield. The non-marketable yield in T_1 and T_2 was about 30% and 41% of the total yield, respectively.

These results would imply that transplanted Pechay at high density planting could be susceptible by the attacked of insect pest rendering the plants unsuitable for human consumption. This current study cannot further explain the causes or reasons why T_3 has the highest non-marketable yield because of insufficient data on the occurrence and damage on insect pest. Therefore, follow up studies should be conducted to evaluate the effect of planting method and planting density on the susceptibility of Pechay to insect and pest damage.

Table 4: Yield Component and Pechay Grow under Different Method of Cultivation at 30 days

Treatments	**Total yield** (kg/m^2)	**Marketable** (kg/m^2)	**Non Marketable** (kg/m^2)
T_1 - Direct Seeding Close-distance planting	6.357 a	4.407 a	1.95 c
T_2 - Direct Seeding – Sparse planting	5.961 a	3.461 a	2.5 b
T_3 - Transplanted Close-distance planting	6.858 a	3.275 a	3.583 a
T_4 - Transplanted – Sparse planting	3.08 a	2.247 a	0.833 d
P value			
Planting method	0.246ns	0.124ns	0.973ns
Plant density	0.059*	0.185ns	0.050*
Planting method x Plant density	0.133ns	0.956ns	0.009**

Means followed by the same letter (s) are not significant different for each other based on two-Way ANOVA and DMRT at 5% level. ** is highly significant, *is significant and ns is not significant.

Cost and Return Analysis

Table 5 shows the partial cost and return analysis of the different cultivation method and planting density of small scale Pechay production. The analysis was based on the 1 square meter areas. Based on the analyses, the gross sales and variable cost did not differ significantly between the methods of planting and plant densities. The highest gross sale was 176.30 pesos per square meters in T_1, followed by 138.96 pesos for T_2, 131.00 pesos for T_3, and 89.87 pesos for T_4, respectively. The total variable differed between types of planting wherein, transplanted Pechay incurred higher labor cost but lower cost on seeds while direct seed Pechay had lower labor cost but higher cost on seeds. The net income was highest in T_1 amounting to 80.63 pesos per meter square followed by T_2 amounting to 43.71 pesos per meter square, and 18.26 pesos per meter square for T_3. Only T_4 has net loss among the different treatments amounting to -18.36 pesos per meter square. Because of high variability within treatments (between replication), there was no statistical differences on the net income (net loss) due to different treatment combination.

ISSN- 2350-0530(O), ISSN- 2394-3629(P)
DOI: 10.5281/zenodo.3262105

The partial analysis of return of investment showed variable values ranging from 0.85 to -0.17 for a 45 days period. Highest partial ROI was in T_1 followed by T_2 at 0.47 and T_3 at 0.16. Based on this result of partial cost and return analysis, direct seeding of Pechay at high planting density is most profitable while transplanting Pechay seedling at low density planting is the least profitable.

Table 5: Cost and return analysis of small scale Pechay production from different method of cultivation and planting density in Northern Samar for one cropping period (45 days cycle)

Particulars	**T_1**	**T_2**	**T_3**	**T_4**
Gross Income (Php)	176.29	138.44	130.99	89.87
Production Cost (Php)				
Seeds	6	1.5	6	1.5
Seedling tray	0	0	14	14
Fertilizer				
Urea	24	24	24	24
Vermi compost	16.67	16.67	16.67	16.67
Labor	49	52.56	52.06	52.06
Total Variable Cost (Php)	95.67	94.73	112.73	108.23
Net Income (Php)	80.63	43.71	18.26	-18.36
ROI	0.85	0.47	0.16	-0.17

4. Conclusion

The following are the conclusions derived from this study: (1) The survival rate and growth of Pechay based on the actual number of plants, transplanted plant with high density plants was significantly higher compared to other treatments indicating that transplanted pechay at high density is favorable than other method because of higher number of plants that could grow per unit area. (2) The fresh weight of Pechay after 30 days of cultivation showed that direct seeded Pechay in T_1 and T_2 had significantly higher compared to other treatment. (3) The total yield per plot and marketable yield had no significant differences between different method of cultivation and planting density. Only the non-marketable yield had significant differences between treatments had occurred. (4) Partial cost and return analysis, direct seeding of Pechay at high planting density is most profitable while transplanting Pechay seedling at low density planting is the least profitable.

References

[1] Awodun MA, Omonijo LI, Ojeniji SO. 2007. Effect of Goat Dung and NPK Fertilizer on Soil and Leaf Nutrients Content, Growth and Yeild of Pepper.
[2] Barrett CA, Zotarelli L, Paranhos LG, Dittmar, Fraisse CW, VanSickle JJ. 2015. Optimum Planting Configuration for High Population Plastic Culture Grown Cabbage. That HortScience 50, 1472-1478.
[3] Dela Cruz NE, Aganon CP, Patricio MG, Romero ES, Lindain SA, Galindez JL. 2006. Production of organic fertilizer from solid waste and its utilization in intensive organic-based vegetable production and for sustaining soil health and productivity. pp16-20.
[4] Dixon GR. 2006. Vegetables Brassicas and Related Crucifers. CABI.In: *Crop Production Science in Horticulture Series*, Vol 14, pp.327.
[5] Gardner, V.R. 1957. Basic Horticulture.The MacMillan Company. New York. P. 330.

ISSN- 2350-0530(O), ISSN- 2394-3629(P)
DOI: 10.5281/zenodo.3262105

[6] Hall, A.D. 2004. Ferltilizers and Manure- London, John Murry Publishers, p.330.

[7] Laurie, S.M, Maja, M.N., Ngobeni, H.M., Plooy,C.P. 2015. Effects of different types of mulching and plant spacing on weedcontrol: canopy cover and yield of sweetpotato (*Ipomeabatatas(L.)*. Am J Exp *Agric*. 5, 450-458.

[8] Locasio, S.J. 2005. Management of irrigation forvegetables:past, present, and future. *Hort Technology* 15: 482-485.

[9] Moyin-Jesu, E.I. 2007. Effects of some organic fertilizer on soil and coffee (*Coffee arabica L*), leaf chemical composition and growth University of Khartoun *Journal of Agricultural Science*; 15(1):52-70.

[10] MucMullun J.P. and Ware G.W. 2005.*Producing Vegetables Crops*. Danville Ilinois, The State Printer and Publishers Inc.2005. P. 26.

[11] Mercado, T.V 2004. How Vegetables in the Philippines Which Culture Uses, p.84-85.

[12] Torrefiel, D.B.Jr. 2006. Growth and yield performance oh pechay(*Brassica napus L.*) as influenced by biogas digester effluent and rice hull ash application . Undergrad. Thesis Visca, Baybay, Leyte.

[13] Xu, H.L., R Wang, R.Y.,, Xu, M.A.U Mridha, and S Goyal, 2005. Yield and quality of leafy vegetables grown with organic fertilizations. *Act a Hort*., 627:25-33.

[14] Wazelaki, A., Kleinhenz M.D. 2003. Effect of Drip Irrigation on Yield of Cabbage (*Brassica oleracea L: var. Capitata*) Under Mulch and non Mulch Conditions. *Agric. Water Manag* 58, 19-28.

*Corresponding author.
E-mail address: eunicelluz@ gmail.com