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Application of Pig Manure and NPK 16-16-16 Fertilizer on Germination and Yield of Pakcoy (*Brassica chinensis* L.)

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***Abstract*—**Pakcoy is one of the most popular vegetables for taste and content nutrition; with system-classified cultivation it is easy and efficient. For it is needed to trial activities related comparison between system cultivation in a manner organic, non-organic with system cultivation without fertilizer (is natural) through the utilization compound NPK fertilizers and fertilizers dirt cattle obtained pork from a farm owned by the farmer. The research going on together with Kosabangsa Project (Collaboration Together to Build Nation) phase *Pilot Project* Petra Baliem STIPER Wamena with the University of Tanjungpura Pontianak, in Jayawijaya. Test This is arranged in the form Draft Random Complete (RAL) with repetition divided three times in treatment A (without fertilizer/traditional), treatment B (compound NPK), and treatment C (Fertilizer dirt pig). The results show exists different influences one the same other to growth sprouts plant pakcoy tested try, i.e., treatment C had an effect real so real in increase growth sprouts plant pakcoy; meanwhile, treatment B showed influence real to plant fresh weight. Furthermore, treatment A also has an effect seen only in the speed parameter growth, which is expected to be caused Because the elongation process occurs in plants, which is a physiological process plants obtain source energy from the sunlight.

***Keywords*—**Fertilizer, Manure, NPK, Traditional Agriculture, Pig Feces.

I. Introduction

Vegetables are group plants consumed freshly processed and are needed. Because the guard important health intake of fresh and healthy food to keep healthy and fit. Mustard pakcoy (*Brassica rapa* L.) is known for the cultivation process of vegetables efficient and is easy for Indonesian society (Daulae, 2018). Besides, that is the origin of vegetables from the same genus as mustard, white, and green. Pakcoy is also known as a valuable vegetable sold by a tall and well-liked society because it tastes good and crunchy (Yuniarti *et al*., 2017). Plant Pakcoy is a group of easy mustard obtainable and economical vegetables. The moment This Pakcoy is used in various Cook so that Enough influence needs society (Prasasti *et al*., 2014). According to Barokah *et al*. (2017), plants Pakcoy is a group of plants that mature and have content high nutrition and are useful for the body; among others, they contain good protein, fat, carbohydrates, Ca, P, Fe, vitamins A, B, C, E, and K for health. Besides that, Pakcoy has become the favorite vegetable of the public because of its texture and taste. It can also be seen in the

people so happy in Husoak Village, District Hubikiak, Jayawijaya Regency for cultivating it.

Growth plants are counted since plants germinate, which is also supported by the fertility rate of land as a growing medium for plants. Productivity plant pakcoy in Jayawijaya Regency so far This belongs low. It is caused by several factors, such as technical characeristics of planting traditional, factor climate, and fertility ground the type of land on the land farmer is clay known as the land which is not productive for the plants. Besides that, factor climatic and technical planting do become condition plant optimum production; however, with activity farming done, it will work so that a step beginning in farming needs preparation material for good planting. Quality seeds are tied to viability and vigor seeds (Yikwa, 2022). The seed itself has the meaning as the seed of the plant used and has agronomical properties (Lesilolo et al., 2013). Besides seed quality, an important factor that must be noticed in the increased production plant is the level of fertility ground.

In Indonesia, fertile land is always a factor that becomes a problem in farming, especially for system agriculture in the Central Highlands region of Papua, still traditionally implemented, as farmers in Husoak Village, District Hubikiak did. In comparison, fertilization is matter important in farming. The type of fertilizer used consists of fertilizer inorganic (compound NPK) and organic fertilizers (manure livestock), which is the available fertilizer used to enhance the productivity of soil and plants. In other words, activity cultivation plants are inseparable from fertilization. Giving fertilizer to plants aims to increase achieved results. Enhancement production agriculture must Align with the other resident moment. The need will result in agriculture. Keep increasing in line with society's needs, so the technology that can increase results in agriculture (Purba *et al*., 2021). One technology that can be improved and developed is technology fertilization.

Farmers of Pakcoy vegetables use fertilizer chemistry such as urea, SP36, K_2O, and fertilizers compound (Phosfate). However, using fertilizer chemistry is a consideration Because they are often expensive and too difficult to find when the season plant arrives. Use fertilizer chemistry on the plains and tall mountains Jayawijaya So far, this is not allowed remembered, given the impact on the ground. However, for each objective of agriculture sustainable organic, it is necessary for the study related impacts and benefits of using fertilizer inorganic, which will base policy on decree rules actual area with proof accurate, through trials gift NPK fertilizer on plants Pakcoy.

Giving inorganic fertilizer is required for the availability of nutrition-sufficient and flat land. Fertilizer, the NPK Mutiara compound (16:16:16), is a type of fertilizer with macronutrients most plants need. Its application is very influential for plants. It is caused by balance from the presence of nutrients N, P, and K and is a more efficient in-plant application (Zein & Zahrah, 2013). Another advantage of using compound fertilizer is that it is more homogeneous in fertilizer distribution (Vidya et al., 2016). NPK (nitrogen phosphate potassium) fertilizer is today's most widely known compound fertilizer. One type of fertilizer that contains the nutrients N, P, and K is widely sold in agricultural kiosks today is Phonska fertilizer. Phonska fertilizer is a compound fertilizer containing the primary nutrients N, P, and K with an NPK composition of 15-15-15 (containing 15% N, 15% P205, and 15% K20). The existence of this compound fertilizer can be an alternative to the recent scarcity of SP36 fertilizer and the high cost of Potassium fertilizer at the farmer level (Rohimah et al., 2019). NPK Phonska fertilizer 250 kg/ha + 2.5 tons/ha of organic fertilizer (Petroganik) can increase fresh tuber yield per plant and dry tuber yield per plant (Suwandi et al., 2015). According to Kurniawati *et al*. (2015), the content fertilizer Mutiara 16:16:16 NPK compound is 16% N, 16% P_2O_5, and 16% K_2O. So called a fertilizer compound and contains macronutrients with good balance for growing plant.

Based on the results study by Syafrizal *et al*. (2017), the treatment of pearl NPK fertilizer against plant mustard greens (*Brassica* et al.) impacts real for high parameters plant, amount leaves, and production per plant the dose best is 10 g/plot. Next, the results study by Gunawan (2019) also shows the influence real from NPK fertilizer (16:16:16) on plants pagoda mustard (*Brassica mariposa*) against the number of leaves per plant, weight wet per plant, root volume, biomass crop, and ratio header root, with a dose of 5.0 g/ plant as does best. However, along with developments and health demands, awareness about the importance of agriculture sustainability is growing. Followed by how difficult to get and the high price of fertilizer chemistry moment, farmers expect to use and process organic fertilizer originating from waste cattle, nature cheap, available, and friendly environment like dirt cattle pork (Nokas *et al*., 2015). Dirt or feces is waste of organic nature, biodegradable, and easily broken down by microorganisms. Feces contain compounds plants need, such as nitrogen, phosphorus, and potassium. For example, chicken feces of contains 0.80% phosphorus and 0.40% potassium. In addition, compost from market organic waste also contains phosphorus and potassium (Kaswinarni & Nugraha, 2020). Livestock produces as much as 30 kg of feces per day (Faturrahman et al., 2015). If we calculate it in a year, livestock can produce feces as much as 10,950 kg or 10.95 m3 (Anonymous, 2023), and testing use of fertilizer from dirt cattle pigs on yield study by Ahmed *et al.* (2013) in a manner significant capable increase production soy.

Use fertilizers is organic yet maximum used by farmers in the village of Husoak, District Hubikiak, in system cultivation is carried out whereas fertilizer is the part most important in cycle life plants, especially on the ground system planting traditionally applied by farmers so far. Farmers think that the source of nutrition for the plant has provided by nature. This belief and applied with a known shifting cultivation model needs time for return fertility to return after one season them. Besides, farmers in village Husoak are also farmers breeding pigs so far. This utilization of waste cattle has yet to be utilized in a manner maximum. Whereas organic fertilizer has been

considered a replacement use fertilizer, chemistry also plays an important role in system cultivation plants because they can repair soil properties (physical, chemical, and biological) (Misdiani *et al.,* 2020). Condition land in the District Hubikiak need for done processing carries on so that it contains organic matter, system aeration land walk well so that growing plants to produce maximum. On the other hand, if system planting is Still done traditionally and depends on nature only, technical cultivation plants are implemented.

Organic materials used in farming processes such as compost, green manure, manure, crop residues (straw, stover, corn cobs, sugarcane bagasse, and coconut coir), livestock waste, industrial waste that uses agricultural materials, and municipal waste can nourish the soil and reduces pollution and hazardous waste levels so that the soil is safe from the degradation process (Hasibuan, (2015); Kamsurya & Botanri, (2022)). It is also supported by the research of Karim et al. (2020) that the application of 2.000 Kg/hectare^{-1} chicken manure gave the best results on the growth and yield of mustard plants in all parameters observed. It is known that farmers in Husoak village are also breeder processing pork waste from owned livestock and not utilizing fertilizer, whereas dirt pig needs to be corrected. One type of potential manure increases the growth of plants. There is material organic through gift fertilizer organic in a manner sustainable on the ground, which is the cheapest and easiest management. Only with notice quality from organic materials used.

Quality organic material becomes a determinant in the decomposition process of mineralization material organic. Dirt pigs are known for much waste found in the area of Wamena and its surroundings. Because farmers, in general, also act as breeder pigs. Waste cattle pig is a source material that can become organic fertilizer if managed with pig feces. It can make a solution for land that has undergone a degradation process, using fertilizer chemistry and land that keeps going continuously.

Using land continuously in business agriculture is known to impact the decline remember fertility of land Good, physical, chemical, and biological. For that, alligators can be done in overcome problems the is with good fertilization (Widodo, 2022). It is known that the use of organic fertilizer is beneficial Because it contains all the necessary elements; the land also plays a role as adhesive particle land, so aggregation and structure of land become. Organic Fertilizers are applied to increase the organic or C- organic and total N content in the land (Zulkarnain *et al.,* 2013).

Many results the study put forward that land agriculture that is intensively processed for business agriculture has experience degradation and decline in productivity land. It is related to very low organic C-content inside the ground. For this reason, organic materials or fertilizers are indeed very beneficial for increasing agricultural land productivity by improving the soil's physical, chemical, and biological properties. In addition, organic fertilizers can also reduce environmental pollution, inhibit evaporation, enrich soil enzyme systems, and improve soil pH (Roidah, 2013; Hartatik *et al.,* 2015). Furthermore, organic fertilizers do play an important role in the process of loosening the soil, especially the topsoil of the soil, compared to inorganic fertilizers by increasing the population of microorganisms, increasing the absorption and storage capacity of water, which as a whole can increase soil fertility (Firman, (2015); Taisah *et al.*, (2021). Fertilizer organic is easily obtained and or made from various sources like remainder harvest, garbage House stairs, dirt animals, and others. According to Kusuma (2012), one alternative fertilizer possible cage used is fertilizer pen dirt cows, goats, and chickens are also feces expected pork can increase growth sprouts Pakcoy.

Based on the description above, the objective it took place to study is to know the different systems of cultivation of Pakcoy in a manner traditional and modern through gift fertilizers (organic and inorganic) as well as without fertilization used to increase growth sprouts plant Pakcoy through trials gift fertilizers organic dirt cattle pork and dosage NPK fertilizer 16-16-16.

II. Methodology

This research was conducted from September until December 2022, located in Husoak Village, District of Hubikiak, Jayawijaya Regency. Tools used include a shovel, machete, meter, container seedlings, scales analytics, scissors, knife, glass measure, and tools write. At the same time, the material study consists of seed plant pakcoy, fertilizer pen dirt pigs, and NPK fertilizer (16:16:16).

The research implementation consists of preparing place research, cleaning from grass, and processing land. For furthermore formed beds, plant with size 1 x 1 m, application treatment given fertilizer with sowing and mixing with the ground (flipping through the soil) to mix evenly, then flush and leave during a week before planted, planted done after a week gift fertilizer with distance plant 15x15 cm and per hole filled with 2-3 seeds Pakcoy. After planting, stages are observations made two weeks after plant. The observation was done on the parameters of viability and vigor seed and Plant fresh weight four weeks after plant. Then, stages maintenance (watering, replacement plants, weeding, control pests and diseases, harvesting)

The research arranged in Suite Draft Random Complete, divided into three series treatments that are without fertilization/system traditional (A), treatment NPK fertilizer (16:16:16) (B) with a dose of 1 kg/plot and administration fertilizer organic dirt pork (C) with a dose of 2 kg/plot. Data observations were analyzed using ANOVA (F-test); if the study results showed a significant effect, then the analysis was continued with the DMRT (Duncan Multiple Range Test) tests at a 5% level. (Gomez & Gomez, 2010).

III. Result and Discussion

Research results show different influences between viability seed, vigor seed, and plant fresh weight. The yield study shows significant differences in each parameter observed on the viability and vigor seed parameters.

Table 1. Observation Results of Viability, Vigor, and Plant Fresh Weight Parameters Pakcoy

Treatment	Viability (2 WAP)		Vigor (2 WAP)			Fresh Weight (4 WAP)
	Growth Speed	Power Germination	Vigor Index	Growth Simultaneous	Growth Potential	
A	4.13 a	34.67 b	48.00 c	57.44 c	52.33 c	61.33 b
B	2.75 b	49.44 a	71.67 b	76.33 b	82.22 b	86.67 a
C	3.91 ab	52.89 a	91.67 a	96.00 ab	94.11 a	84.78 a
CV	36.02	17.79	24.68	18.03	12.33	16.45
F	*	*	**	**	**	*

Description: Numbers in One column followed by a letter. The same is No different real according to DMRT with α = 5 %; *: Affected real; **: Very real effect; WAP: Week After Plant

Table 1 shows that treatment A (without fertilizer) affects real treatment B (given NPK fertilizer) on the speed parameter growth, then on the power parameters germinate, index vigor, simultaneity growth, and potential growth. Treatment C (given pig fertilizer) shows influence real so real to treatment A (without gift fertilizer). However, on observation of fresh weight pakcoy, treatment B (given NPK fertilizer) shows influence real to treatment A (without gift fertilizer).

Influence real on the speed parameter growth shown by treatment A (Without fertilizer) is suspected Because plants manner physiological impose self For get source generated energy sun to develop breed so that matter This is an elongation process plant consequence happening elongation cell plant For obtain energy besides of known soil nutrients in the treatment This No gave fertilizer and only hope for content existing organic matter as This is current system agriculture applied farmer local in Wamena. In general, this is a physiological process plant that will do a plant cycle its life.

Although they grow and develop like plants in treatment, others look at the power parameters germinate, index vigor, simultaneity growth, and potentially grow show slow and delayed growth. If compared to with treatment fertilizer inorganic (NPK) and organic (dirt cattle pig), treatment A (without fertilizer) shows an average Lowest If compared to with second existing treatment additional fertilizer. This show that good seeds, though, if on planting. No given fertilizer, so the seed can grow but need a long time. Meanwhile, it can be said that seeds showing slow growth are b Penh with vigor low and cause late emergence process seeds early in the field, especially in conditions less than ideal land (Umar, 2012). Circumstances this explains that gift fertilizer impacts plant growth as an essential nutrient contributor. It is supported by research results, Gani *et al.* (2021) state that macro and micro essential nutrients are very important for plants to help physiological processes run well. Macronutrients such as nitrogen (N), phosphorus (P), and potassium (K) are needed in large quantities by plants. Meanwhile, micronutrients such as iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), boron (B), chlorine (Cl), and molybdenum (Mo) are needed in small amounts.

Increasing the physiological response in the plant body (photosynthesis rate) impacts plant growth. Especially also if the nutrients needed are met and can be absorbed by plants for photosynthesis, which produces photosynthate and is used for the vegetative growth of plants (Yustiningsih, 2019). Photosynthate will be translocated to the roots, stems, and leaves in the vegetative phase. The increase in photosynthate in the vegetative phase causes cell division, elongation, and differentiation (Zuhro *et al.*, 2018). It shows that the pattern of photosynthate distribution is not only determined genetically, but hormonal and environmental factors are also very influential (Sarawak & Baco, 2014). Photosynthate production is strongly influenced by various environmental factors, including; light, temperature, CO2, water, and mineral elements (Lina *et al.*, 2014). The main role of nitrogen for plants is to stimulate overall plant growth, especially stems, branches, and leaves. In addition, nitrogen also plays an important role in forming green leaves, which are very useful in photosynthesis. Another function is forming proteins, fats, and other organic compounds (Setyanto & Nasirudin, 2013).

Next, the power parameters germinate, index vigor, unison growth, and potential growth show that treatment C (given fertilizer dirt pigs) impacts real so real to treatment B (given NPK fertilizer). It shows the physiological quality of seed Pakcoy walks under the local environment. Quality physiological seed is compared between plant genetic factors and environment growth the seed is planted. To obtain seed with a high-quality start, the environment of plants, including fertile land, must be optimal for plants to produce seed with high vigor (Umar, 2012).

Given dirt pigs on germination plants, Pakcoy is considered an additional nutrient supply Because fertilizer chemistry has Not yet replaced function (Novizan, 2002). Zulkarnain *et al*. (2013) also stated that compost could increase C-organic content and N-total, yielding results in sugar cane harvesting. Pig manure contains high nitrogen elements to be used as raw material for compost. Potassium content in pig manure is two times higher than in cow and goat manure (Irfan *et al.*, 2017; Widyasari et al., 2018). It is known that nitrogen and potassium are needed by plants as stimulant growth plants to accelerate the process of photosynthesis plant.

Dirt pig role as Fertilizer organic can support the growth of plants through the swelling process of the land consequence of the height activity of microorganism land,

increased existence of microorganism land, increased power to absorb water, and power save all the water is factor determiner fertility land (Pandelaki *et al*., 2021). It is especially known that shit pork used has undergone a period of fermentation mixed with EM4, which is a microorganism activator working add- on speed up the fermentation process. Besides that, its use can push the resulting odor during decomposition (Moenek & Toelle, 2019). Activity microorganisms cause the temperature of compost to increase moment stacked or known by a thermophilic process. After this phase, compost temperature and pH will return and be replaced with phase cooling, followed by phase maturation compost (Widyasari *et al*., 2018). It is a cold fertilizer dirt pig. It makes it known, too, with the designation fertilizer cold. Because fertilizer of pig feces is capable of releasing nutrients slowly or known as fertilizer *slow release* (Novizan, 2002), Nitrogen (N) is an integral part of the chlorophyll molecule, and therefore, an application of sufficient Nitrogen (N) will result in lush, vegetative growth and dark green leaf color (Tando, 2018).

Next, presumably because the content of N (Nitrogen) in fertilizer dirt pig in condition enough for fulfilling need plant. It is known that the role of the main N for plants is to stimulate growth fully, particularly stems, branches, and leaves (Lingga & Marsono, 2001). Besides that, N also plays an important role in forming very useful chlorophyll in photosynthesis. At the same time, gift NPK fertilizer (treatment C) showed average under treatment B, presumably existence in condition excessive. Because increasingly tall the dose applied, such a result will also be decreased. It is in line with the opinion of Putri (2016) that the use of fertilizer chemistry in an excessive manner would impact the declining quality of plants, the quality of land, and the environment. Also added by Purba *et al.* (2021) is that fertilizers given in extreme conditions cannot be utilized by plants properly. It can lead to lower soil quality and hurt the environment. Therefore, using fertilizers must be done wisely and following the needs of plants. Efficiency in the use of nutrients is meant so that evaporation does not occur when fertilizer is applied and so that it can completely decompose until it can be absorbed by plants, so that there is not much fertilizer left in the planting area, and results in economic losses for farmers due to decreased soil quality. Loose because the remaining fertilizer can bind to the soil and cause clumps (Herawati *et al.*, 2019). For this reason, Hartono *et al.* (2022) stated that the fertilizer given to plants must be adjusted to the needs of the plants by taking into account the levels of nutrients available in the soil. So that no cause plant experience nutrient to be poisoning.

Effectiveness NPK fertilizer (C treatment) on pakcoy seen on the fresh weight of plants that did not influence real with treatment fertilizer dirt pigs (treatment B) and influential real with treatment without fertilizer (treatment A). It is suspected because NPK 16-16-16 fertilizer can be absorbed with kind and positively influences the weight parameter of wet plants. Condition absorption is best suspected Because NPK 16-16-16 fertilizer contains several elements such as 16% N (Nitrogen), 16% P_2O_5 (Phosphate), 16% K_2O (Potassium), 0.5% MgO (Magnesium), and 6% CaO (Calcium) which play a role in growth stems, roots and leaves (Fadilla, 2018).

Furthermore, the results of Pratiwi's research (2012) also showed that the fresh weight of mustard plants was affected by the number of branches, the high growth capacity of mustard plants, and conditions of adequate nutrient supply. The increase in plant fresh weight is also influenced by the tissue's water content, especially in physiological processes involving water and dissolved materials. However, when observing the plants' fresh weight, the planting area was also rained to absorb water in top condition. In other words, the fresh weight of the plant is a mirroring of nutrient content inside the network plant, including water. Water with organic material will form bonds with hydrogens, such as proteins and carbohydrates (Triono *et al*., 2018).

Felania (2017) also argues that the availability of sufficient water to meet plants' water needs is very important. The role of water in plants is as a solvent for various organic molecular compounds (nutrients) from the soil to the plant, transporting photosynthate from the source to the sink, maintaining cell turgidity including cell enlargement and opening of stomata, as the main constituent of protoplasm and temperature control for plants. Suppose the availability of groundwater could be improved for plants. As a result, water as a raw material for photosynthesis will hamper the transportation of nutrients to the leaves, which will impact the resulting production. Water translocation is carried out through the xylem by transporting nutrition from the root to the leaf for through photosynthesis. According to Simatupang *et al*. (2016), increasing the process of photosynthesis also affects water absorption, so formed carbohydrates result in plant experience enhancement plant fresh weight. Ascension's fresh weight and volume will be increased in line with the differentiation process cells, which are related to the enhancement results of fresh weight. In the process of plant photosynthesis, element K plays an important role apart from opening and closing stomata, maintaining cell turgidity, activating enzymes, and also playing a role in the formation of carbohydrates, proteins, and fats stored in plant tissues (Subandi, 2013).

Furthermore, implementing the fertilization recommendations needs to be supported by the understanding and common perception of all parties, including farmers, extension workers, researchers, entrepreneurs, and policymakers. Technology products produced by the Ministry of Agriculture lead to the determination of location-specific fertilizer doses in each sub-district throughout Indonesia, one of which is an Android-based information system, such as the Integrated Planting Calendar. The strategy for applying the recommended fertilization information through this product is quite promising if developed into an application like SIPINDO. That way, farmers can easily access information on fertilization recommendations (Hartono *et al.*, 2022).

IV. CONCLUSION

The results showed that the experiments carried out had different effects between the treatments of compound NPK fertilizer, pig manure and no fertilization as the farmer's cultivation system so far applied. The effect shown had an impact on the growth of the sprouts of the pakcoy plants tested. Research results show that treating fertilizer dirt pigs can increase seed viability and vigor, as seen from the power parameter average germinate, index vigor, simultaneity growth, and potential growth. Meanwhile, the treatment gift effect of NPK fertilizer significantly on the fresh weight of the plant. The results of this study simultaneously answer the rejection of traditional farmers in Kampung Husoak in utilizing fertilizers (both organic and non-organic) derived from livestock manure or even chemical fertilizers that have been widely used compared to applying traditional agricultural systems which affect the results of crop cultivation obtained. Because it is relatively low and requires a long time.

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