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# The Impact Of Benefit-Risk Factors And Source Of Information On Liquid Chemicals Fertilizers Utilization: A Case Study For Onion Farmers In Brebes, Central Java, Indonesia

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***Abstract:*** *Fertilizers come in different forms, grades and formulations. There are two major classes of fertilizer: solid and liquid for handling purposes. The farmers behavior for utilization liquid fertilizer not only can be influenced by rational factors (benefit-risk), can also be influenced by source of information (community, extension workers and dealers/traders). This study aimed to analyze the impact of benefit-risk factors and source of information on liquid chemicals fertilizers utilization: a case study for onion farmers in Brebes, Central Java, Indonesia. This research was conducted by using a survey approach through interviews to 100 respondents of onion farmers in Brebes Central Java on April - May 2015. Factors influencing in utilization the liquid fertilizer products were analyzed by logistic regression analysis approach. The research found that the utilization of liquid fertilizer influenced by the benefit factor for production activities, the benefits of growth plants, ease of use, farming community information, extension workers information, dealers/traders information, land and irrigation.*

***Keywords:*** *benefit-risk factors, source of information, liquid fertilizer utilization*

## I. Introduction

Brebes, Central Java Province is the main production areas of onion in Indonesia. The agricultural sector accounts for 53 % of Gross Domestic Product (GDP) Brebes district, which is 50 % of the onion farming [1]. Onion cultivation becomes an important activity in the life of society. Fertilization is an activity to support the onion farmers business. An intensive use of fertilizers to keep the crop yields onion farmers. Farmers generally take advantage by using both solid and liquid fertilizer forms; solid fertilizers for heavy pre-plant applications and liquids preferred for starters and in-season applications.

Advantage of liquid fertilizer include quick plant response, lowered application cost, homogenity, ability to combine with other agrochemicals in a single application, higher nutrient concentrations, and the ease of making compound fertilizers [2] [3]. Liquid fertilizer programs are less expensive than dry only if materials are purchased as concentrated liquids [3]. Liquid fertilizers are popular because of the ease of handling and application [4]. Homogeneous liquid fertilizers, in contrast to solid fertilizers, present no special problems during application by the farmer. Furthermore the storage of liquid fertilizers is less difficult than that of solid ones. Small amounts of herbicides and insecticides can be mixed with liquid fertilizers far more easily [2]. Whereas the disadvantages of liquid fertilizer include the drawbacks that they usually have lower nutrient content and are sensitive to impurities, as well as to precipitation and crystallization, especially caused by magnesium and fluorine [2]. The liquid fertilizer system is that it requires special storage and application tanks and pumps, which greatly increase costs [4]. Liquid chemicals fertilizer utilization with the product in a more exaggerated agrochemicals have a certain amount of risk. Agrochemicals can also damage the surrounding ecosystem and other living organisms necessary for maintaining ecological balances [5].

In addition to rational factors (benefit and risk), the farmers behavior in the liquid fertilizer utilization also influenced by the social environment and marketing stimuli [6][7][8]. The farmers information sources about benefit-risk of liquid fertilizer can be derived from the social environment and market. Farmers social activities can obtain the formal and informal information [9][10][11][12]. Socio-cultural activities of farmers will increase farmers' relationship with the group, so the potential for farmers to obtain feedback, suggestions, references information from the group (such as: friends and neighbors, farmers' organizations, credit groups, village meetings, village leaders) [12]. Farmers can easily influenced to follow the neighbor who managed to increase their agricultural production through the use of certain types of fertilizer [9][12]. Community farmers generally difficult to transfer in the use of certain types of fertilizer used in the long term and is believed to increase their agricultural production [9][12]. Farmers who have successful experience in the use of certain types of fertilizer is likely to be the type of fertilizer for production in the next period [9].

Dealers/traders can influence the preferences and attitudes of farmers through: product, price, distribution and promotion [12][13][14]. Fertilizer products to encourage farmers to have loyalty in using a specific fertilizer products or switch from other fertilizer products. Farmers will consider the purchase of

fertilizer products at the lowest possible cost with relatively equal quality. Farmers will choose a fertilizer that is available in stores and not far from home or their farmland. In addition to product, pricing and distribution, promotion party dealers/traders often affect the knowledge, perceptions and attitudes of farmers in addition to information and local agricultural extension. This study aimed to analyze the impact of benefit-risk factors and source of information on liquid chemicals fertilizers utilization: a case study for onion farmers in Brebes, Central Java, Indonesia.

## II. Research Methods

The study was conducted in Brebes Central Java in April to May 2015. There are 11 districts (out of 17 districts) with harvested area 20,000 - 25,000 hectares per year. Based on data from the Department of Agriculture, Food Crops and Horticulture in Brebes [1], the onion centers are spread in the district of Bradford, Wanasari, Bulakamba, Tanjung, Sejong, Kersana, Ketanggungan, Larangan, Songgom, Jatibarang, and Banjarharjo. The respondents (farmers) interviewed were selected using multi-stage, purposive and random sampling techniques in ten wards of the study area. First five villages were purposively selected based on onion centers and liquid fertilizer utilization. They are: Bradford, Wanasari, Bulakamba, Tanjung, Sejong, Kersana, Ketanggungan, Larangan, Songgom, Jatibarang, and Banjarharjo. A sample of 100 onion farmers formed the sample size.

Methods of analysis in this study using logistic regression analysis model with the following equation:

ADOPT = f (Benefit-Risk, Social-envronment, Marketing Stimuli, Control Variable)

$ADOPT=\alpha_0 + \alpha_1 BENEFIT1 + \alpha_2 BENEFIT2 + \alpha_3 BENEFIT3 + \alpha_4 RISK + \alpha_5 COM + \alpha_6 EXT + \alpha_7 MARKET + \alpha_8 SIZE + \alpha_9 IRRIG + \varepsilon$

Where: ADOPT= utilization of Liquid fertilizer (1= adopter, 0= non-adopter), BENEFIT1 = production benefit (3= much, 3= intermediate, 1= little), BENEFIT2 = impact of plant growth (3= much, 3= intermediate, 1= little), BENEFIT3 = easy to use (3= much, 3= intermediate, 1= little), RISK = agrochemical risk (3= much, 3= intermediate, 1= little), COM = the information from community (3= much, 3= intermediate, 1= little), EXT = the information from extension worker (3 = very often, 2 = often, 1 = never), MARKET = the information from dealers/traders (3 = very often, 2 = often, 1 = never), SIZE= Farm area (hm2), IRRIG = access to irrigation (3 = technical, 2 = semi-technical, 1 = rain fed), $\alpha\ \beta, \gamma$ = Intercept and slope, $\varepsilon$ = error

Hypothesis testing is done by wald test as a replacement for the t-test in linear regression based OLS (Ordinary Least Square). The independent variables significant effect on liquid fertilizer utilization if sig, wald test <0.05 (5%). Testing Model fit based on the value of McFadden R-squared and LR Statistic. McFadden R-squared is a measure that seeks to imitate the size of the $R^2$ on multiple regession based on estimation techniques likelihood with a maximum value of less than 1 (one ) so it is difficult to interpret. McFadden R-squared to ensure that the value varies from 0 (zero) to I (one). This is done by dividing the value of Cox and Snell's the maximum value . If the value of LR statistics = or <0.05 means there is a significant difference between the models with observations that the value of goodness of fit model is not good because the model can not predict the value of observations.

## III. Results And Discussion

**Socio-economic characteristics of farmers in the study area**

Farmers personal profile can be seen on the age, education, farmer experience, land area, irrigation systems, conditions of cultivation land and productivity. Personal profile are presented in Table 2. The cultivation of onions in Brebes in general is a family business that has been carried out for generations. Based on Table 2 it can be seen that the onion farmers as respondents in the age range between 23-71 years. Most (60%) onion farmers are already doing cultivation of onions up to 13-45 years. Motivation business establishment of which this is due to the selling price of onion was pretty good with a changing pattern is static, continuing an existing business (a family business), marketing is assured, the natural resources that support, the technology is available or their experience with the skills that simple.

**Table 2:** Profile Personal Farmer as Respondents Research

| respondent | Frequency (n) | Percentage(%) |
|---|---|---|
| Age | | |
| □ 23-35 | 24 | 24 |
| □ 36-47 | 35 | 35 |
| □ 48-59 | 24 | 24 |
| □ 60-71 | 17 | 17 |
| total | 100 | 100 |
| Education | | |
| □ primary school /not complete primary school | 40 | 40 |
| □ junior high school | 32 | 32 |
| □ high school or equivalent | 19 | 19 |
| □ diploma / bachelor | 9 | 9 |
| total | 100 | 100 |
| Farming Experience | | |
| □ 1-12 | 59 | 59 |
| □ 13-23 | 20 | 20 |
| □ 24-34 | 18 | 18 |
| □ 35-45 | 3 | 3 |
| total | 100 | 100 |
| Land, with an average of 0.47 ha | | |
| □ <0,25 ha | 37 | 37 |
| □ 0.25 ha - 0.5 ha | 43 | 43 |
| □ 0.51 ha - 1 ha | 18 | 18 |
| □ 1.1 ha - 2 ha | 1 | 1 |
| □ > 2 ha | 1 | 1 |
| total | 100 | 100 |
| Irrigation systems | | |
| □ Technical (1) | 63 | 63 |
| □ Half Technical (2) | 13 | 13 |
| □ Rainfed (3) | 24 | 24 |
| total | 100 | 100 |
| Conditions of cultivation land | | |
| □ highlands | 14 | 14 |
| □ semi mountainous | 10 | 10 |
| □ paddy fields | 76 | 76 |
| total | 100 | 100 |
| Productivity (ton / ha), with an average of 16.1 ton / ha | | |
| □ 4.08 to 5.68 | 1 | 1 |
| □ 5.68 to 7.28 | 7 | 7 |
| □ 7.28 to 8.88 | 86 | 86 |
| □ 8.89 to 10.75 | 6 | 6 |
| total | 100 | 100 |

Source: Field Survey, 2015

Most of the onion farmers education low as primary school or did not complete primary school (40%), followed by junior high school education (32%) and a high school education (19%). Most rural communities who once studied in college is not interested in working in agricultural activities. Only about 9% of respondents onion farmers with Diploma/Degree. The work as farmers still considered attractive by the graduates with higher education levels. The education level of the majority of farmers of respondents who only finished elementary school can influence the decision making process of purchase of liquid fertilizer which illustrates that improved management of farming by farmers of respondents still strongly influenced by the mindset of conventional ones, especially if there is no consistent effort and maximal in giving examples implementation of the recent discoveries.

Most (59%) samples farmers have experience planting onions over 12 tahun, which consists of 13-23 years of experience (20%), 24-34 years of experience (18%) and 35-45 years (3%). In addition to experience, onion farmers also had several times received training in good farming techniques. Among them is the training of the department of agriculture in the form of counseling the use of pesticides in the form of Integrated Pest Management Field School (FFS), formation of farmer groups and harvest and post-harvest technology onion. In addition, Indonesia Central Bank also conducts training in management and finance / business capital. Exchange information and experience as well conducted onion farmers with employers / onion farmers who have been successful. Various training and experience indicate that onion farmers, especially in Brebes already have a very good skill level. Planting onions can also be done with overlapping shifts, so even though their land is limited, farmers can still alive. Usually after a 30-day-old onion, chili farmers planted on the sidelines of the onion crop. Once the onion is harvested, farmers wait for one month, then harvesting chilies. Several climate factors that are

important in onion cultivation is the altitude, temperature, light, precipitation, and wind. As a commodity that once a mainstay in Brebes.

Shallots are a mainstay in Brebes. Almost every year the farmers are always planting onions. The land area land area illustrates both owned and produced by the farmer respondents in units Ha. Hectarage in the study were classified into five groups. The average tenure onion farmers is approximately 0.47 hectares. The results obtained (Table 2) shows that the majority of farmers (43%) has an area of 0.25 hectares of land ownership - 0.5 hectares. Lowest land area is 300 m2 and the largest land area is 2.7 hectares. Farmers who have extensive holdings of 0.25 hectares of land under 37%. While farmers with an area of over 0.5 hectares of land ownership is 20%.

Planting onions can also be done with overlapping shifts, so even though their land is limited, farmers can still alive. Usually after a 30-day-old onion, chili farmers planted on the sidelines of the onion crop. Once the onion is harvested, farmers wait for one month, then harvesting chilies. Several climate factors that are important in onion cultivation is the altitude, temperature, light, precipitation, and wind. As a commodity that once a mainstay in Brebes.

Most of onion cultivation is done in paddy fields that are irrigated land (76%). Wetland obtain irrigation of the irrigation system, both tapper construction and tissues is regulated and controlled by the irrigation department of Public Works and managed by the community. Irrigated land consisting of consisting of technical irrigation (63%) and semi-technical irrigation (13%). Most small onion cultivation is done on a rain-fed land (24%), which is a mountainous land (14%) and semi-mountainous (10%). Technical irrigation is an irrigation system with the characteristics of the water can be set and measured up to the tertiary channel as well as permanent buildings. Technical irrigation network that is separate from the channel provider discharge channel in order to supply and distribution of water into a wetland that can be fully managed and measured easily. Semi technical irrigated land as well as technical irrigation, but in this case the local goverment only master tappers building to be able to organize and measure the water intake, while at the next network is not measured and not controlled by the local goverment. The characteristics of semi technical irrigation: Water can be arranged throughout the system, but which can be measured only partially (primary / secondary).

Productivity onion varies greatly depending on soil conditions, climate, weather and varieties. Most farmers (86%) had an average productivity of onion between 7.28 to 8.88 tonnes per hectare. Average production of onion is produced by farmers amounted to 8.06 tons per hectare. Lowest production is equal to 600 kg and the highest production of 18 tons. To achieve maximum productivity onion, intensive cultivation have to do so it needs the tenacity and patience that extra, especially in terms of pest and disease control onion. Shallots including commodities that are susceptible to pests and diseases and the extent of damage due to pest attack could lead to crop failure. The characteristics of onion cultivation 60-70% ready to harvest when the leaves have started to fall down. Or, do random checks tubers. Especially for seeding bulbs, the level of lodging must achieve more than 90%. Onion cultivation usually can be harvested after 55-70 days after planting.Yields of onion in addition sent to different regions, also sold directly at the edge of the northern coastal road and other main streets in the form of bonds. The presence of red onion traders who usually becomes one with salted egg merchant, a marker for the vehicles from outside the city, they had arrived in the area of Brebes.

**Source of Information of Liquid Fertilizers**

The result of this study in Table 3 reveals that the majority of the respondents (55%) got their Liquid Fertilizers in the open market while 27% through extension workers and 18% through non-governmental organization. This implies that most farmers obtained liquid fertilizers in the open market.

**Tabel 3**: Source of Information of Liquid Fertilizers

| Source | Frequency (n) | %age (%) |
|---|---|---|
| Extension | 27 | 27 |
| Market | 55 | 55 |
| Community | 18 | 18 |
| Jumlah | 100 | 100 |

Source: Field Survey, 2015

**Most Utilized Liquid Fertilizers**

Within a year the farmers to plant twice, with a time of planting four months of each planting season. The average purchase Liquid fertilizer products onion farmers are presented in Table 4 below.

**Table 4:** Average Number of Purchase Fertilizer (Liter)

| districts | Land (Ha) | Average Purchase (liter) / Spring Planting | | | |
|---|---|---|---|---|---|
| | | I (liter) | II (liter) | Total (liter) | Total / Ha |

| | | | | | |
|---|---|---|---|---|---|
| Bulakamba | 0.26 | 1.62 | 3.00 | 4.62 | 17.75 |
| Ban | 0.33 | 1.81 | 3.53 | 5.34 | 16.19 |
| Kersana | 0.59 | 3.00 | 6,33 | 9.33 | 15.82 |
| Ketanggungan | 0.45 | 2.21 | 4.68 | 6.89 | 15.32 |
| Wanasari | 0.37 | 1.70 | 3.70 | 5,40 | 14.59 |
| promontory | 0.55 | 2.29 | 5.57 | 7,86 | 14.29 |
| Losari | 0.78 | 3.40 | 7.85 | 11.25 | 14.42 |
| Brebes | 0.49 | 2.00 | 4.00 | 6.00 | 12.24 |
| Banjarharjo | 0.38 | 2.10 | 4.25 | 6.35 | 16.71 |
| Jatibarang | 0.72 | 3.33 | 7.25 | 10.58 | 14.70 |
| Songgom | 0.23 | 1.33 | 2.67 | 4.00 | 17.39 |
| **Average** | **0.47** | **2.25** | **4.80** | **7.06** | |
| **Average (liter / ha)** | **1** | 4.81 | 10.26 | | **15.40** |

Source: Field Survey, 2015

Based on Table 4 it can be seen that the average purchase of Liquid fertilizer products by the farmers was 7.06 liter per year consisting of 2.25 liter in the first growing season and 4.80 liter in the second planting season in the average area of land 0,47Ha , For each Ha farmer takes an average 15.40 liter / ha per year consisting of 4.81 liter / ha in the first growing season and 10.26 liter / ha at planting season II.

**Logistic Regression Analysis**

Based on logistic regression analysis that is processed by the eviews program to develop a research model in Table 5. Based on the processing of research data in Table 5 can be performed as an interpretation on every variable. The results obtained the McFadden R-squared value = 0.822. This means that the variability of the dependent variable which can be explained by the variability of the independent variables in the amount of 82.2%. Model fit analysis can also be used to analyse the LR statistic value. LR statistic value = 103.109 (Significance = 0.000 < 0.05). This means the model is avowed to fit (the empirical data equal to the model or the model is mentioned to fit or acceptable).

Factors benefits of liquid fertilizer for production activities (BENEFIT1) (p <0.05), more green plants (BENEFIT2) (p <0.01), and benefits in ease of use (BENEFIT2) (p <0.05), a significant effect on the liquid fertilizer utilization in onion production activity. Generally farmers take the liquid fertilizers fertilizers to provide growth plants. Liquid fertilizers are used together with other fertilizers. Liquid has several benefits to make easier to use as follows [2][3][4][5]: 1) The liquid fertilizer is easily dissolves and absorbed in the soil, 2) Liquid fertilizer can quickly overcome the deficiency of nutrients and provide nutrients quickly, 3) Liquid fertilizer can easily adjust the absorption composition of fertilizer needed, 4) Liquid fertilizers are more evenly and less in buildup, 5) In addition, the Liquid fertilizer can be directly used on the soil and the farmers do not have to take long time to plant. Liquid fertilizers are not only given around the plant, but also above the leaves. Another purpose from the farmers in the purchasing the fertilizers is to increase the production and secure the crop. Fertilizers take role to replace the lost nutrients in the soil which the plant needed. Risk factors for the use of Liquid fertilizer (RISK) no significant effect on the utilization of the use of Liquid fertilizer in onion production activity (p> 0.10). The results can be caused farmers have a low knowledge on the risk of chemical fertilizers.

**Table 5:** The Result of the Logistic Regression Test

| Variable | B | z-Statistic | p, |
|---|---|---|---|
| | | | |
| | | | |
| C | -58.999 | -2.141 | 0.032 |
| BENEFIT1 | 6.888 | 2.236 | **) 0.025 |
| BENEFIT2 | 6.751 | 2.614 | ***) 0.009 |
| BENEFIT3 | 6.168 | 2.135 | **) 0.033 |
| RISK | -0.268 | -0.205 | 0.838 |
| COM | 3.913 | 1.949 | *) 0.051 |
| EXT | 1.226 | 2.009 | **) 0.045 |
| MARKET | 7.889 | 2.076 | **) 0.038 |
| SIZE | 1.114 | 2.379 | **) 0.045 |
| IRRIG | -5.193 | -3.041 | ***) 0.002 |
| | | | |
| McFadden R-squared | 0.822 | | |
| LR statistic | 103.109 | | |
| Prob(LR statistic) | 0.000 | | |

***, ** and *, Significant at p < 0.01, p < 0.05, and p < 0.10, respectively. B= Parameter estimate

Source: Field Survey, 2015

Factor information from the farming community (COM) significantly affects the liquid fertilizer utilization in onion production activity ($p< 0.10$). Farmers community recommendation factors positively affects the utilization of liquid fertilizer. Farmers can easily influenced to follow the neighbor who managed to increase their agricultural production through the use of certain types of fertilizer. Another farmer recommendations can be obtained from the farmer's social activities (formal and non formal information), so the potential for farmers to obtain feedback, suggestions, references information from the group [12].

Factor extention worker information (EXT) significantly affects the liquid fertilizer utilization in onion production activity ($p< 0.05$). Agricultural Extension in addition to having a role in agricultural cultivation information can also be a marketing agent. Agricultural Extension can influence knowledge, perceptions and attitudes of farmers [9][12]. Agricultural extension information is formal resources, while other farmers on a non-formal resources of farmers [9][12].

Factors dealers/traders information (MARKET) significantly affects the liquid fertilizer utilization in onion production activity ($p< 0.05$). The meeting of farmers with the dealers/traders is personal selling activity often done for example in a farmer group meetings or other social activities. Dealers/traders are also often give a good recommendation (as part of a marketing strategy by dealers/traders) as well as the question of farmers to obtain information about the product / brand specific. Personal selling activity by the dealers/traders can influence knowledge, perceptions and attitudes of farmers in addition to information and local agricultural extension. Face to face with a dealers/traders to help provide information and knowledge as possible on what method of use, the advantages of using certain fertilizers in order to increase crop productivity could ultimately also increase the welfare of farmers. Giving gifts is one adaptation strategy to increase sales prices. Gift-giving is often performed by dealers/traders or store to attract farmers to purchase. Services increasing the emotional closeness of farmers and dealers/traders, so as to increase sales.

Factors land (SIZE) significantly affects the liquid fertilizer utilization in onion production activity ($p< 0.05$). The extent of land area increases the scale of farming. Large scale requires more input from suppliers, including the use of liquid fertilizers in increasing agricultural production [10][11][13].

Factors acsess of irrigation (IRRIG) significantly affects the liquid fertilizer utilization in onion production activity ($p< 0.01$). Irrigation system which allows the plant to absorb more fertilizers motivated farmers to apply larger quantities. Land connected to the irrigation networks are usually flat, easily accessible and have the results greatly safer in various conditions of rainfall so that farmers face a lower risk in applying more intensive fertilizing

## IV. Conclusion

The study found that the benefit factor of liquid fertilizer products for production activities, the benefits of growth plants, ease of use, the farming community recommendations, recommendation dealers/traders, land and irrigation are all factors that affect farmers in the utilization of liquid fertilizer. This study contributes related to the behavior of farmers in the purchase of liquid fertilizer products. The research found that the decisions of farmers in the purchase of liquid fertilizer influenced by rational factors (benefit), social factors (community, extension workers) and marketing stimuli.

This study has included a variety of areas in Brebes with a variety of physical environments (eg:-rain-fed irrigation, various agricultural commodities), social and economic as well as social and physical environmental conditions of peasant economy in general in some other regions of Indonesia. Therefore, this study can be used as a reference to the behavior of farmers in purchasing fertilizer. Although the study was conducted in Brebes, research methodology and the same survey techniques can also be performed to study the same problem in other regions, especially other regions due to the characteristics of soil fertility, cultivation knowledge and different socio-cultural farmers.

This study may provide different results if applied in conditions of physical and social environments of different agriculture, as in other countries or other areas in Indonesia which are different from the physical and social environment with research sites. Therefore, further research can do research in other areas with different social and physical environmental conditions and different peasant economy. Further research could also do more in-depth study of the effect of the problem on a wider geographical scale. Both studies are conducted by a survey and analysis of the determinants approach in order to provide limitations to include the variable of time, for example relating to the supply of, demand for fertilizer, and the price along with substitute products from time to time. These factors may be factors that can affect the amount of fertilizer use.

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