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Typology of Agricultural Upstream Area of Watershed on Intensive Fertilizer Behaviour on Conservation of Natural Resources in Bedadung

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Typology of Agricultural Upstream Area of Watershed on Intensive Fertilizer Behaviour on Conservation of Natural Resources in Bedadung

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Abstract. Bedadung is one of the biggest river in Jember, East Java Indonesia. The typology of agricultural upstream of watershed is needed as conservation on the management of natural resources. The activity of intensive agricultural give the influence significant to decrease environmental quality. The behaviour of farmer use the fertilizer according to intensive make the problems on the soil and water. The aim is understanding the farmer behaviour on using fertilizer and to give recommend fertilizer application as to be truly on it. This method was conducted rapid rural appraisal (RRA) with the complete questionnaire for to understand about the behaviour of farmer. There are many steps was did (1) mapping location for taking the sample respondent based on water flow, (2) selected respondent did random sampling, (3) collecting data was cluster analyzed to appropriate the application fertilizer, (4) making a recommend to type conservation for the keep our environment dan conservation of natural resources. Based on the type spread the intensive fertilizer is used of farmer from Urea=60.62.42 kg/ha, Kaltim=54.03 kg/ha, Ponska=47.38 kg/ha, and KCl=27.33 kg/ha. The fertilizer is used the farmer was covered from the rule which is decided.

Keywords: Typology, Intensive, Resources, Behaviour

1. Introduction

Fertilization is an activity providing plant-growth promoting, soil healthy, and promote plant development to increase production [1]. Fertilization is part of farming activities carried out by farmers. Fertilizers are used by farmers as an effort to increase income from farming. But the use of fertilizer on a large scale causes environmental problems.

Watershed is part of natural resources that have high environmental value [2][3][4]. Bedadung River is the largest river in Jember Regency. The people of Jember use the Bedadung river as a source of life. One of the upstream of the Bedadung River is located in Sucopangepok Village, Jelbuk and is directly adjacent to the Argopuro mountains. According to Munandar and Eurika, 2016 in the Bedadung River was polluted by Pb and Cd in the biotic component [5]. Therefore the assumption that agricultural activities in the upstream reach so high. So that carried by the water flow to the downstream. Intensive fertilization can cause environmental problems. Heavy metal contamination of



Pb, Cd, Na is the result of intensive fertilization activities[6][7][8]. So management is needed related to the use of fertilizers so that it is safe for the environment and other biotic components.

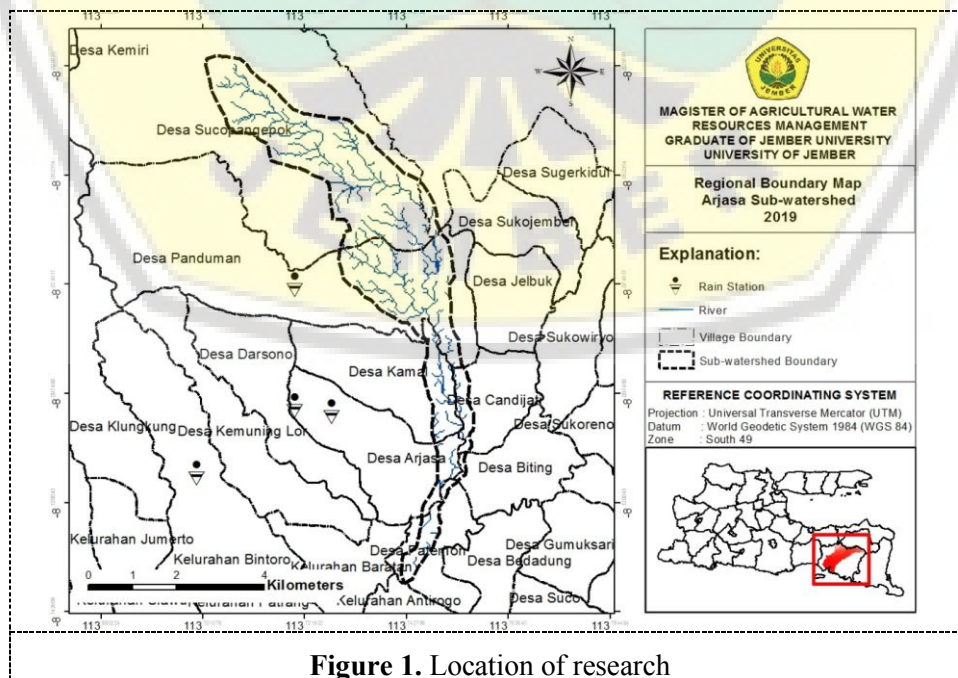
Upstream areas are designated as conservation or what we know as water catchments. However, the change of land use change from forest to agriculture raises several problems. In 2014 the latest data was obtained in the upstream portion of residential land use covering an area of 71,564 hectares, irrigated rice fields 206,207 hectares, rain-fed rice fields 79,586 hectares, gardens 164,718 hectares, and fields 161, 467 hectares [9]. Identical rice fields are planted with food crops such as rice. But during the dry season, chilli and tomatoes are planted. As for the fields and gardens the majority of farmers grow sengon. Plants with vegetation that are not by with the typology of land will cause a decrease in soil quality such as erosion, landslides, and decreased soil fertility [10][11][12]. These plants are plants that require fertilizer in large quantities. This encourages farmers to use fertilizers that are not in accordance with the recommendations. So that a special study is needed on the typology of upstream agriculture on an intensive use of fertilizer in the upstream part of the Bedadung watershed.

Typology is needed to know the characteristics of upstream agriculture [13][14][15]. This is correlated with farmer's behaviour related to fertilizer use. To find out the behaviour of farmers, an anthropocentrism approach is needed for so that farmers have a sustainable nature. Supporting data is needed why farmers use excess fertilizer. So based on this it can create a model to manage the behaviour of farmers to wisely use fertilizer. If the use of fertilizer can be contaminated, the environment will be balanced and sustainable.

2. Methods

2.1 Study area

This type of research included in the Expos Facto (Lord and Harold, 1973; Bayyan, 2016). Examine the causal relationship by gathering data as support in concluding. The study was conducted in an area of one of the headwaters of the river, namely in the village of Sucopangepok with a height of 880 meters above sea level. The village is directly adjacent to the Argopuro mountains (On Figure 1). The majority of farmers are more dominant in growing food crops (rice, corn), horticulture (chilli, beans, long beans, tomatoes, eggplants), and plantation crops such as tobacco. The research area which has desirability of 9-15% with the category of ramps with Latosol soil types.



2.2 Characterization of the behaviour farmer

2.2.1 Data collection

Information obtained by survey method by rapid rural appraisal completed by questionnaire [16][17][18]. Approximately 60 farmers consisting of men and women as respondents were selected by random sampling. The purpose of the survey is to find out and examine the characteristics of farmers in fertilizing to increase crop production. The composition of the questionnaire that has been made consists of (1) respondent identity, (2) land status, (3) types of cultivated plants, (4) types and dosages of fertilizer used.

The survey was conducted in January-May 2019. To find out the behaviour of farmers, a periodic survey is needed to provide assistance and increase the capacity of farmers' resources regarding fertilization activities. This aims as an effort to prevent the behaviour of farmers by using fertilizer intensively. Then an inventory of factors that influence fertilizer activities in the upstream watershed in the high category is carried out.

2.2.2 Typology

Farmer's behaviour by using fertilizer intensively requires typology based on the characteristics of farmers so that it can be a reference to reduce fertilization on plants. Based on the results of interviews with the questionnaire seen how the typology of farmers against the use of fertilizers in the upstream river basin. Farmer typology data based on respondent's identity is presented in Table 1.

Table 1. Respondence identify in upstream watershed

Variabel	Level	Unit	N
Total response	Man	People	42
	Woman	People	18
Age	20-30	Years	7
	31-40	Years	13
	41-50	Years	21
	51-60	Years	19
Region Community	Moeslim	-	60
	Maduries	-	59
	Javanesse	-	1
Education	No School	People	10
	Elementary	People	35
	Junior	People	12
	Senior	People	3
	S1/S2/S3	People	-
Demography	Original	-	-

Tabel 2. Variable is needed on typologies agriculutral on fertilizer

Variable	Description	Unit
Fertilizer	Amount of fertilizer (Urea, Ponska, Za, dan Kaltim)	Kg/ha/plant periode
Wide Plant	Total land use Types of plant whice is planted (Paddy, corn, and chilli)	Hectare (ha) Plant
Topography	Slope (9-15)– Slightly	%
Soil	Latosol	-
Water Resources	Irrigation, water storgae, sources	-
Types plant farming	Paddy, corn, and chilli	-

System planting	Monoculutre	-
Varians Planting	Food-Horticulture-Horticultutre	-

Table 2 it can be seen that in determining the agricultural typology in the upstream area, several variables are needed as supporting data in the classification. The use of fertilizers on cultivated plants that are applied are Urea, Ponska, East Kalimantan, and Za. Farmers assume that using as much fertilizer as possible will result in increased crop production. So far the knowledge of farmers about fertilization can be said to be still lacking. This correlates with the level of education. The level of education influences the behaviour or actions taken [19][20]. Therefore a solution is needed to change the behaviour of farmers related to fertilizer use. Based on the survey results the majority of farmers have never used organic fertilizer.

2.2.3 Data Analysis

The fertilizer use such as dose (kg/ha) are inputted in Ms. Excel and analyzed the Hierarchy cluster using SPSS 20. Then it was examined more deeply based on the results of the farmers cluster related to the use of fertilizers for cultivation needs. For data related to factors that influence the use of excess fertilizer will be analyzed by LFA (Logical Analysis Framework). The results of the LFA analysis can be a solution to change the behaviour of farmers and increase farmers' knowledge about the principle of fertilization.

2.3 Conceptual modelling

Results of enumeration to farmers by gathering several facts related to the factors that trigger intensive use of fertilizer are presented in table 3. The correlation between several factors is related to expert justification. The results of the LFA analysis can be elaborated through a concept by looking at several factors that have been identified. The results of the LFA analysis will be divided into important constituents, namely the root of the problem and the focus of the issue.

Table 3. Identification problem why farmer using on intensively

Problems	in	out
Low soil quality	1	0
Low education level	2	1
Poor government	0	3**
Disable technique of fertilizer	3*	1
Poverty society	1	0
No farmer society	1	1
*)Focuss issue **)Root problem		

3. Results and Discussion

3.1 Interview

The average farmer in the upper watersheds in farming more often uses fertilizers such as Urea, East Kalimantan, Ponska, and KCl. Based on table 1 of the descriptive analysis results obtained information on the dose used for each type of fertilizer. This type of fertilizer is used for rice, corn and chilli. In the type of Urea fertilizer the minimum dose used is 31.70 kg/ha and the highest dose is 93.30 kg/ha. In East Kalimantan fertilizer the dose used was 23.30 kg/ha and the highest dose was 70.00 kg/ha. The lowest dose of Ponska and KCl fertilizer used by farmers is 25.00 kg/ha and 11.70 kg/ha. Whereas the highest dose is 80.00 kg/ha and 70 kg/ha. The four types of fertilizers were applied at the beginning of planting, the change of vegetative to generative phases, and approaching harvest. The average area of land used for rice, maize and chilli crops is 200-300 m² for each farmer. But so far the farmers have only relied on the principle of heredity in conducting fertilization activities.

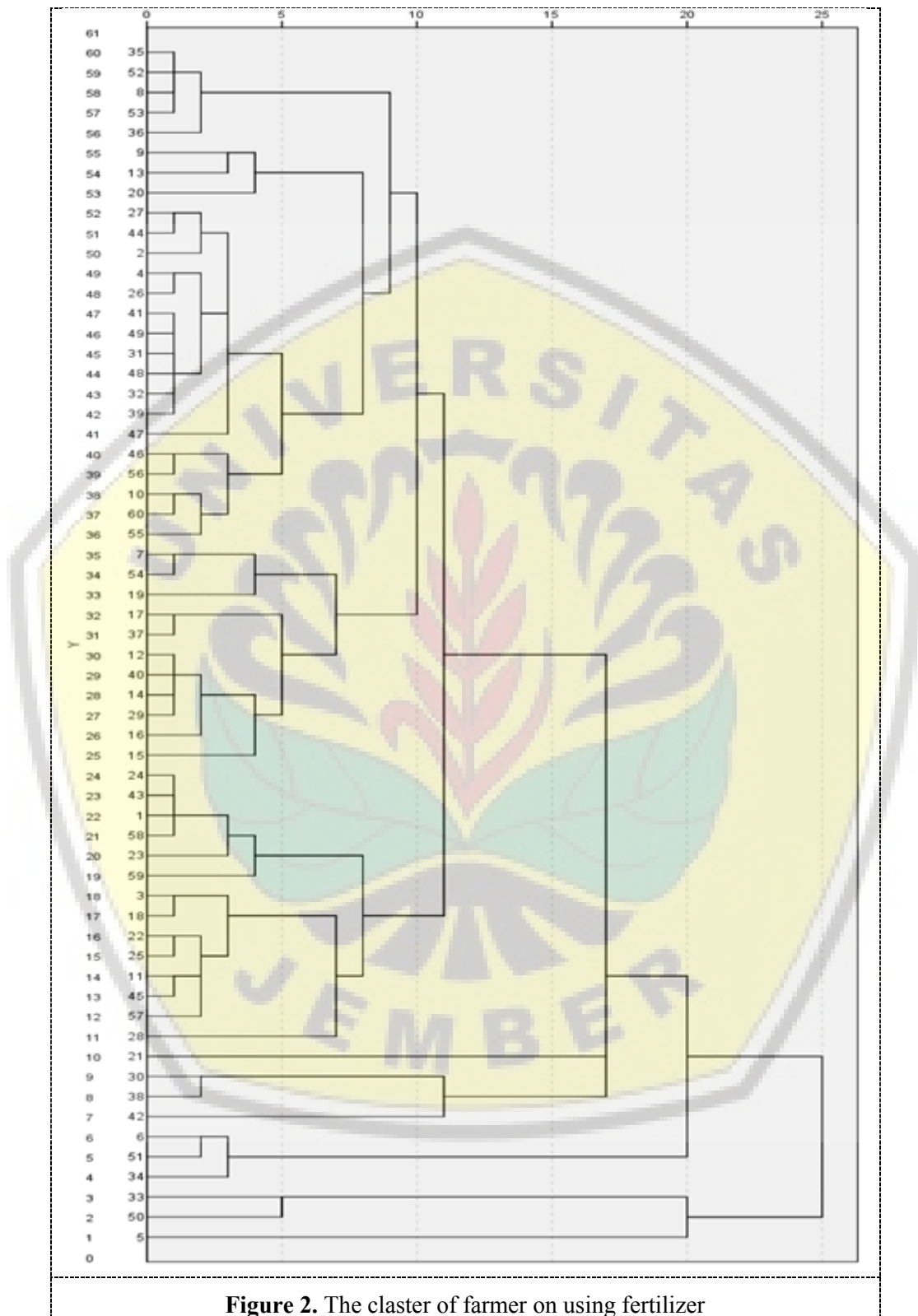
Reference for fertilizer use must refer to Minister of Agriculture Regulation No. 40 / Permentan / OT.140 / 4/2007. Based on the type of plant, fertilizer recommendations must be regulated that must

be applied. There are several things to consider before fertilizing namely, (1) location-specific macronutrient detection analysis, (2) observation of leaf colour chart, (3) as well as a combination of organic fertilizer can be considered. The obstacle faced by farmers at this time is not knowing the principles in conducting. The importance of fertilizer is not yet known, so farmers believe that fertilizer used in large quantities does not have an impact on the environment and health. The importance of farmer groups and assistance in fertilizing has a significant effect on the conservation of sustainable natural resources [21][22][23].

In Figure 2 can be seen based on the results of the cluster hierarchy analysis obtained as many as 60 respondents recorded for how many doses are used for rice, corn, and chilli. Dose data results obtained were analyzed for clustered groups of farmers who exceeded the specified dose. The Y coordinate is the number of respondents' order and x-axis (horizontal) is the number of farmers based on cluster results. Clusters used are divided into 4 clusters, 3 clusters, and 2 clusters. The clustering aims to group farmers based on the number of doses used. The grouping is used to see the characteristics of farmers' behaviour related to knowledge about fertilization activities.

Table 4. The analysis descriptive dose of fertilizer in upstream farmers

	N	Minimum	Maximum	Mean	Std. Deviation
Urea (Kg/ha)	60	31.70	93.30	62.0550	11.84575
Kaltim (Kg/ha)	60	23.30	70.00	51.0267	11.38624
Ponska (kg/ha)	60	25.00	80.00	47.3783	11.71771
KCL (Kg/ha)	60	11.70	70.00	27.3283	14.58303
Valid N (listwise)	60				



3.2 Typology

Dose data collection is then grouped by type of plant. The pattern of dose distribution and fertilizer used can be seen in Figures 3.4 and 5. In Figure 3 is the dose distribution pattern in paddy. Lowland

rice is the biggest fertilizer consumption compared to other plants. The cultivation system is inundated so the amount of fertilizer that must be applied must be massive. Fertilizers that are applied to flooded land are mostly leached. So that not all can be absorbed by plants. The calculation of the correct fertilizer dose must consider the following factors: (1) based on the level of rice productivity. At a level of less than 5 million / hectare it is categorized as low productivity. Whereas more than 6 million / hectare is categorized as high productivity. Between 5-6 million / hectare is categorized as medium. So that these conditions the recommendations used are also different. Recommended fertilizer recommendations can be seen in table 5.

Table 5. Recommendation of fertilizer is needed based on productivity level.

Productivity	Class	Rekomendasi
<5 million/hectare	Low	200 kg/hectare
5-6 million/hectare	Medium	250-300 kg/hectare
>6 million/hectare	High	300-400 kg/hectare

Table 5 is a recommended recommendation for urea (N) fertilizer for lowland rice based on productivity. In figure 2 the highest dose of Urea used is 100 kg / hectare. Some farmers still do not use East Kalimantan fertilizer in rice cultivation. The type of fertilizer used is still derived from the assumption of farmers based on the yields obtained. The yields obtained in several periodic experiences are dynamic. So the assumption that certain fertilizers do not produce significant results needs to be examined. In figure 3, urea fertilizer is still used in large quantities with 100 kg / hectare for chilli plants. Based on the growing season, chilli plants are planted during the dry or dry season. Application of urea during the dry season under sun-exposed conditions will occur evaporation. Different in Figure 5, the maximum use of 90 kg / hectare is the use of urea fertilizer in corn plants. In principle, farmers in the upstream Bedagung watershed do not know the correct fertilization techniques in terms of cultivation.

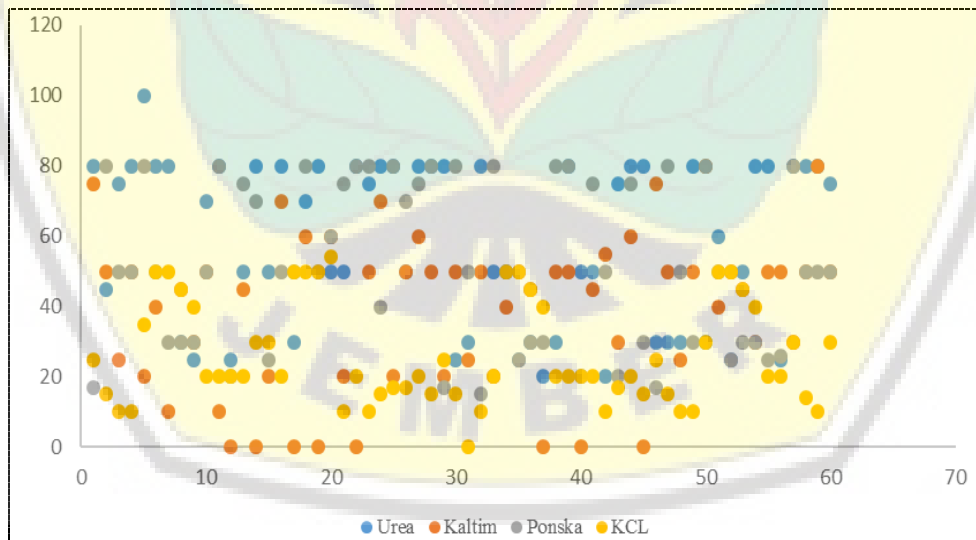


Figure 3. Pattern using fertilizer on paddy

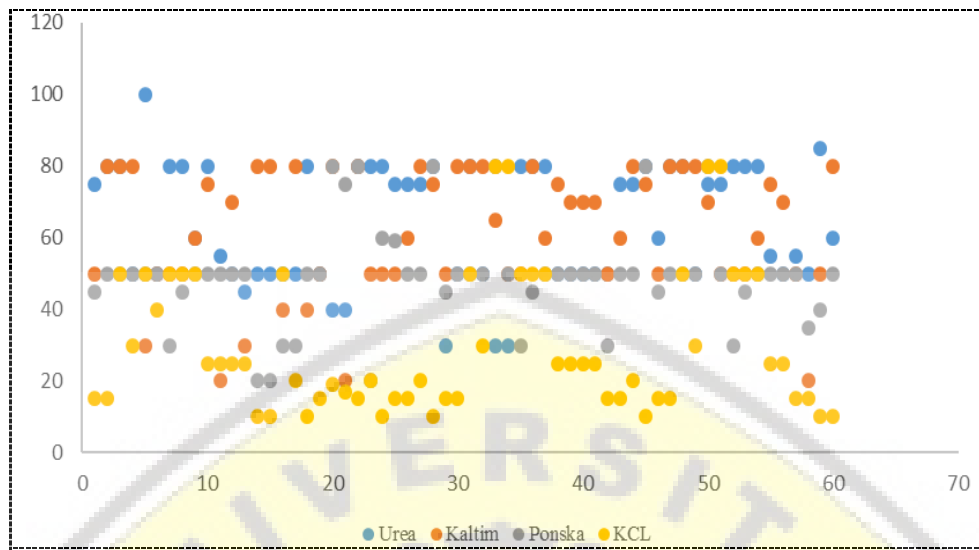


Figure 4. Pattern using fertilizer on chilli

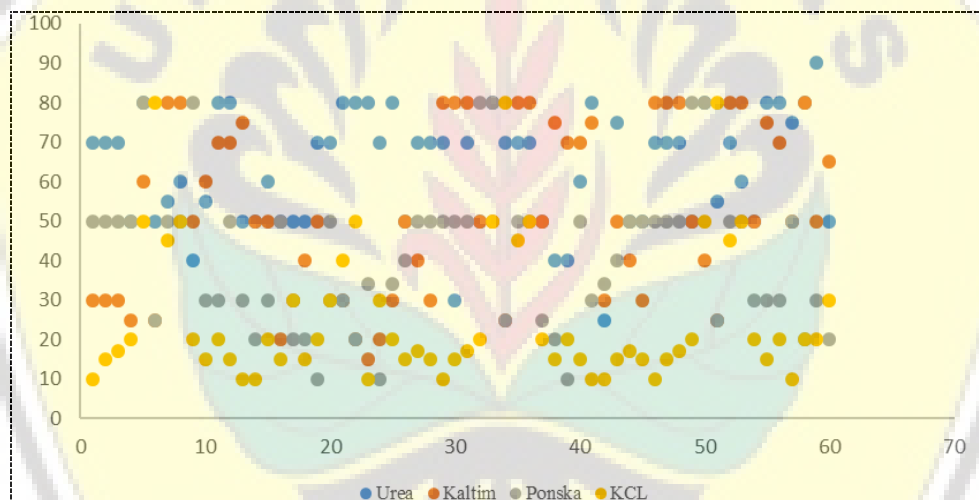


Figure 5. Pattern using fertilizer on corn

3.3 Conceptual modeling

In the results of the identification of problems in RRA in table 3, then an LFA (Logical Analysis Framework) analysis is carried out by justification expert [24][18]. In Figure 6 is a concept of the management model in changing the behaviour of farmers towards intensive fertilization. Based on the typology of agriculture that has been identified, the concept approach to sustainable agriculture management models. Typology helps in changing the behaviour of farmers to change behaviour towards the use of excessive fertilizer [13][14].

Figure 5 shows that the focus of the issue and the root of the problem can be resolved through a focus group discussion (FGD) between the government and farmers. Through this meeting a farmer group can be formed. Many benefits are obtained in the formation of farmer groups [25][21][26]. Then through mentoring and supervision farmers are given training and knowledge of sustainable agriculture through watershed conservation of fertilizer use behaviour so that pollution and environmental contamination do not occur.

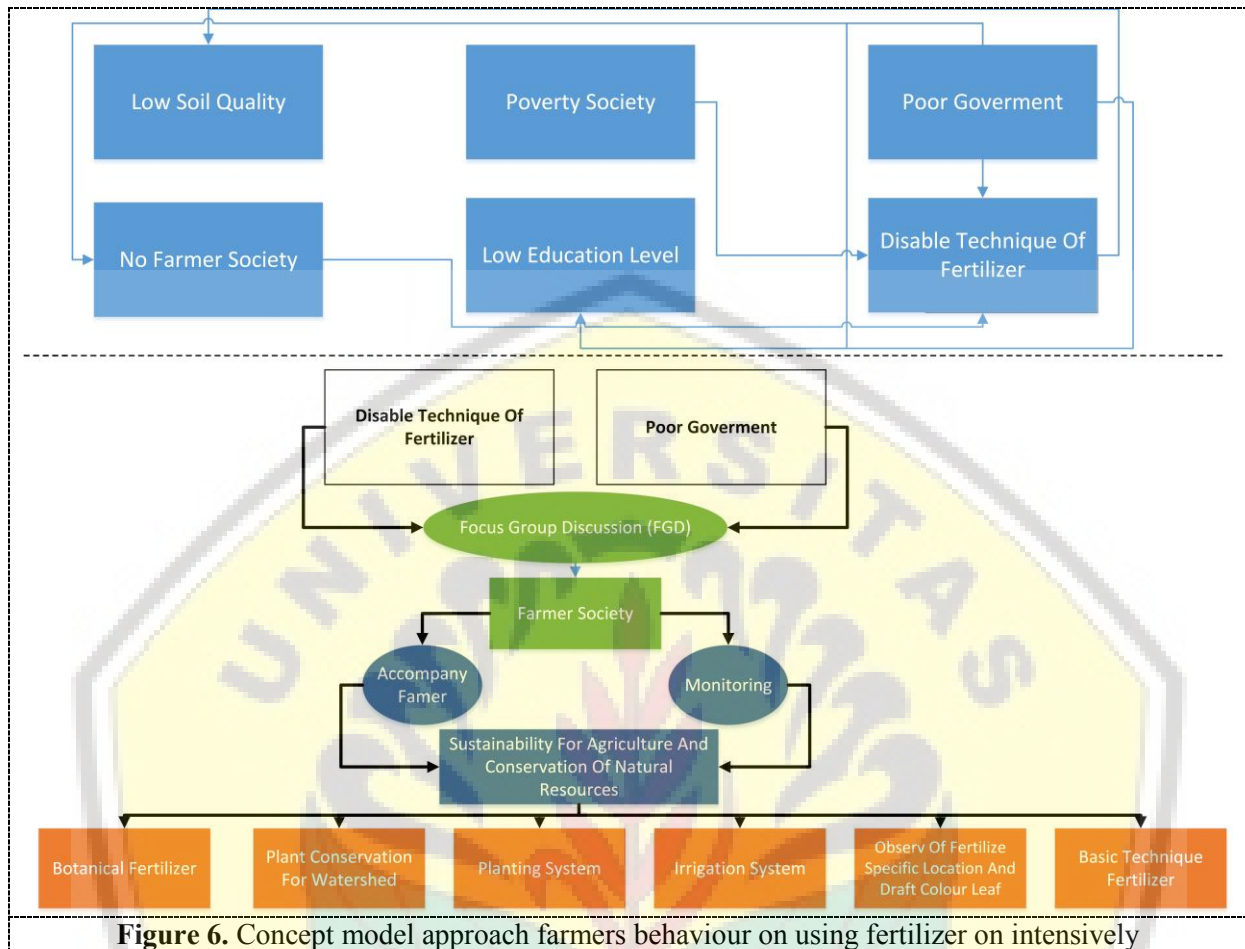


Figure 6. Concept model approach farmers behaviour on using fertilizer on intensively

4. Conclusion

Agriculture in the upstream watersheds in the use of fertilizers for crops can be said to be high. The type of fertilizer and dosage used by farmers consisted of Urea = 60.62.42 kg/ha, East Kalimantan = 54.03 kg/ha, Ponska = 47.38 kg/ha, and KCl = 27.33 kg/ha. The results of the LFA analysis in identifying the problem of farmers using excess fertilizer are influenced by government involvement and farmers lacking knowledge and techniques of fertilizing principles. Then through several approaches a concept model was formed to change farmers' behaviour towards intensive use of fertilizer through focus group discussions (FGD) to produce farmer institutions.

Farmer institutions formed can run sustainably through mentoring and monitoring programs towards sustainable agriculture and conservation of natural resources. Changes in farmer's behaviour have a significant effect on the hydrological condition of the watershed. Therefore, it is necessary to change the behaviour of farmers in using fertilizer wisely.

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