THE STUDY OF HERBICIDE KINDS AND TILLAGE METHODS ON THE GROWTH AND YIELD OF MUNG BEAN (*Vigna radiata L*)

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ABSTRACT

The objective of this research was finding the answer to comprehend the influence of herbicide kinds, tillage methods, and interaction between them on the growth and yield of mung bean (*Vigna radiata L*). The thinking background of this research is that mung bean is not tolerant with weed competition, meanwhile herbicide that can control weed on mung bean crop hasn't been found yet. Sometimes tillage is need to control weed, too. But the effect of tillage on increasing the yield of mung bean hasn't been completely recognized.

The research was carried out in Karangasem village, Surakarta, in about 106 meter height sea level water, at Entisol soil. The research was designed with Randomized Completely Block Design (RCBD) that arranged according to Split Plot Design, that had 2 factors with 12 treatment combinations and every combination was replicated 4 times. The first factor was tillage method as main plot, that had 3 levels as follows : no-tillage method (P0), one time tillage method (P1), and two times tillage method (P2). The second factor was herbicide kind as sub plot, that had 4 levels as follows : control (H0), Isopropylamine Glyphosate herbicide/Roundup (H1), Oxadiazone herbicide / Ronstar 250 EC (H2), and Oxyfluorfen herbicide / Goal 2E (H3). The result was analyzed with Analysis of Variance on 1% and 5% level and then analyzed with Least Square Design (LSD) test if Anova test showed significant result.

From the result of this research, we can concluded that Roundup is able to increase total mature pods and dry seed weight of mung bean, but not significantly affecting all other research variables. Goal and Ronstar can make the plant height and fresh plant biomass of mung bean lower, and not significantly affecting total mature pods, total immature pods, total unfilled pods, dry seed weight, and 100 dry seed weight of mung bean. Meanwhile Ronstar is not significantly affecting. Goal can make the dry plant biomass of mung bean lower. The tillage method treatments and interaction between tillage method and herbicide kind treatments is not significantly affecting all studied variables.

Keywords : Herbicide, Tillage, Mung bean

INTRODUCTION

Mung bean is one of the quite important *Leguminosae* in Indonesia. Its position is in the third place after soybeans and peanuts. According to the Suprapto and Sutarman (1991), mung bean have several advantages if it is compared with other legumes, in examples : Mung bean is more dry-resistant, the number of pest and disease is relative a bit in number, the age of genjah (early-ripening of mung bean) it can be harvest on 55-60 days, it is able to be planted on the barren area (less fertile soil), at also have a little risk on the harvest failure, and the most important thing is that it can be directly consumed by farmer only by a simple processing, i.e. : can be made a sprouts, porridge of mung bean, baby's food, cake and traditional food, and mung bean drink.

Besides having some advantage, mung bean also have some disadvantages. According to Kasno and Sutarman (1992) the disadvantages or the weakness of mung bean plants are the unstable yield that caused by the unsufficient ability in overcome the grip of physical environment, mostly the excess of water, and the

grip of biological environment, especially the competition with weeds. Mung beans are not a kind of plant that can be compete with weeds, especially on the beginning stadium of growing. Because of that, the weeds restraint is very important in every plant growing fase, especially in the beginning (Purnomo and Rahmianna, 1992).

The weeds, which always grow around the crop result in the decline of the rate of growth and yield harvest as well. The weeds existence are dangerously the persistence growth and it is obscure the achievement of the plantation production target in the general. The human trial to overcome this problems are including the weeds control which is depending on the plants, on the planting purposes, and the expences as well. Cultivation of the plants and its management is still become a sufficient effort in agriculture. By the herbicide invention, the poisoning event and the measurement of the dosage in the restrain degree is still considered, and it is as well as about mode of action and the residue effect (Moenandir, 1993). In order to restraint other weeds, Esrita and Akmal (1992) classified the importance of using herbicide as follows :

1. Thrift in time and energy. It is only need a short time to restraint the disturbing plants, so the rest of time can be used to other activities.
2. The restraint of disturbing plants can be focused on a valuable time, in addition, it is not merely more than 1/3-1/4 of plants age.
3. The crop area can be extended, thus the farmer able to operate the wide agricultural work.
4. The mechanical cleared way of weeds is very difficult if it is done in the row, and it is often damaging the measurement system.
5. Herbicide able to reduce the interference of soil structure, furthermore, the death disturbing plants has a function as *mulsa* and then it will create the decomposition and it also will increase the nutrient substance.

Herbicide can be classified into several things. According to Moenandir (1990), based on the use of application time, herbicide can be devided into :

1. Pre-cultivation herbicide, it is application before soil processing and also before planting process.
2. Pre-planting herbicide, it is application before planting, but after soil processing.
3. Pre-growing herbicide, it is application before the plants is growing.
4. Post-growing herbicide, it is application after the plants is growing as well as its weeds.

Thought a few roots may find their way through the hard layer (Vepraskas *et al.*,1995), solid soil generally prevent roots from taking water and nutrients from lower horizon. As a result, yield is reduced (Sojka *et al.*, 1991). Three tillage treatments (no-tillage, conventional, twice soil tillage) were implemented during the fall of 1994 and 1995 in areas that had been previously cropped to soybean (*Glycine max (L.) Merr*) in the southern USA (Wilson *et al.*, 2000). Conservation tillage, in particular no-tillage, generally leeds to greater retention of soil organic matter than conventional tillage (Kern and Johnson, 1993; Paustian *et al.*, 1997 in Needelman et al., 1999). According to Suprapto (1993), mung bean mostly planted after rice harvest and it can be with nor without soil tillage. But, in order to optimize the production, soil tillage is the major factor, and it is mostly for solid soil. The soil processing will help the seed germination, which is later on would result on the occuracy and various maturation. Besides that, Harjadi (1993) states that sometimes, it is the soil processing that used the weeds restrained. For instance, the cleared way of rowing plants (corn, legumes) able to decrease the weeds grass for rice plant again.

Current practice in the soil tillage is to reduce soil strength by surface tillage. Because the soil reconsolidates between growing seasons, surface tillage is required annually (Threadgill, 1982; Busscher *et al.*, 1986 in Busscher *et al.*, 2000). According to Tranggono (1994), soil tillage is defined as a mechanic manipulation to soil. A soaked soil practice caused aggregate detachment and made the soil being a

homogenous suspension when is floaded happen. Floading practice influences physical, chemical and biological properties of soil in a long and short term.

Purpose

The purpose of this research are :

1. Knowing the influence of herbicide models to growth and result of mung bean
2. Knowing the influence of soil tillage to growth and result of mung bean
3. Knowing the influence of interaction between herbicide models and soil practice to growth and result of mung bean.

METHODOLOGY

This research is using Completely Randomized Design (CRD) with Split Plot Design Arrangement by 2 treatment factor with 12 combination and 4 replication per combination.

The treatment factor are :

1. Soil practice as main factors with 3 levels :
   P_0 : Without soil tillage
   P_1 : Once soil tillage
   P_2 : Twice soil tillage
2. Herbicide models as sub plot factors with 4 levels :
   H_0 : Without herbicide
   H_1 : Isopropanilamina glyfosat (Roundup) herbicide
   H_2 : Oxadiazon (Ronstar 250 EC) herbicide
   H_3 : Oxyflourfen (Goal 2 E) herbicide.

   So its will results 12 combinations :

P_0H_0	P_0H_1	P_0H_2	$P0H_3$
P_1H_0	P_1H_1	P_1H_2	P_1H_3
P_2H_0	P_2H_1	P_2H_2	P_2H_3

The result from this experiment is analyzed using Analyze of Variance (Anova) and continued with Least Significant Different Test (LSD) if its significant.

The stage of this research :

a. Soil tillage
   1. For the within soil tillage, the soil is not being manning.
   2. For once soil tillage, the soil is being hoed 20-25 cm one weeks before cultivation.
   3. For twice soil tillage, the soil is being hoed 20-25 cm and one weeks later, the soil is hoed again to detach and flat the soil until its loose.

b. Making the embankment

c. Spraying the herbicide
   1. Roundup 1 litre/hectare or 0,288 cc/compartment is sprayed to the surface 21 days before cultivation and 37 days after.
   2. Goal 2E 1 litre/hectare or 0,288 cc/compartment is sprayed to the surface 21 days before cultivation and 1 day before.
   3. Ronstar 250 EC 2 litre/hectare or 0,576 cc/compartment is sprayed to the surface 21 days before cultivation and 2 days after.

d. Cultivation

e. Fertilizing

f. Safeguarding

g. Harvesting.

RESULT AND DISCUSSION

From analyze of variance in table1 at appendix, the only treatment that giving significant and highly significant influence to growth and yield mung bean plant is herbicide models, the other treatment is giving less one. This condition came out because the soil that used in this research is having good structure from the ancient soil tillage before. Its postulated that Entisol is having crumb till sub angular blocky structure and friable till firm consistence (Darmawijaya, 1992). But according to Kartasapoetra et al.(1991), soil preparation is needed when the soil compact enough and delaying plant growth. If friable soil is being tillage again, it will be more friable and more erosive if the rain drops.

Table 1. The analysis result for all treatment

Variable	P	H	P X H	High average	Low average
Plant high	ns	**	ns	P0H1 = 57,43 cm	P0H3 = 23,245 cm
Fresh weight plant	ns	**	ns	P0H1 = 28,548 gr	P0H3 = 5,078 gr
Dry weight plant	ns	**	ns	P0H1 = 11,828 gr	P0H3 = 1,7575 gr
Number of mature seed	ns	**	ns	P2H1 = 7,35	P1H0 = 3,6
Number of young seed	ns	Ns	ns	P0H1 = 0,75	P0H3 / P1H3 = 0
Number of empty seed	ns	**	ns	P1H1 = 3	P0H3 = 1,55
Dry weight of seed	ns	**	ns	P2H1 = 4,5905 gr	P0H0 = 2,02 gr
Number weight 100 seeds	ns	Ns	ns	P2H0 = 6,959 gr	P0H3 = 6,179 gr

Explanation :

ns = not significant
* = significant
** = very significant
P = soil tillage
H = herbicide
P X H = interaction between soil tillage and herbicide

According to 5% LSD, Roundup herbicide is increasing old pod total, dry seed weight and non significant to height fresh and dry weight, total young pod and dry weight 100 mung bean seeds. Roundup herbicide can increased green pea product because it's delaying the experiment plant but it's in toxic to main plant. According to Nasution (1992), herbicide with glyfosat isn't giving residue in soil because its degraded. Roundup is used after cultivation so the influence is seen after plant passing its young stadium. Moenandir (1993) was said that young plant is very responsive to herbicide.

Goal and Ronstar is tend to poisoning the plant in young stadium. So that, the 5% LSD shown that Goal and Ronstar is decreasing plant height, fresh and dry weight of mung bean seeds, but the poisonous effect is disappear after plant passing its vegetative stadium. This condition is shown from significant result comparing to the control in total old pod, total young pod and total empty pod, seed dry weight and dry weight of 100 mung bean seed. This is suitable with Loomis and Connor (1992) who said that real plasticity appear in all plant growth stadium. A bad stressing in vegetative stadium like in the differentiation of branch usually can compensated in number of pods or seeds if good condition plant.

Analysis of covariance result showing experiment kind of herbicide, tillage and the interaction not significant to variable amount of young seed show that its function more depends on genotype factor, than external factor. Variation amount of young seed an pigeon mung bean more depends on differences variety, that some of varieties mung bean mature at the same time and the others not. According to Suprapto (1993) variety number 129 has characteristic: mature seed at the same time. These amounts of young seed are not many.

Table 2. Result of LSD test for herbicide kinds for all treatment

Variable	Control	Roundup	Ronstar	Goal
Plant high	49,768 cd	53,725 d	37,995 b	28,453 a
Fresh weight plant	20,59 cd	25,67 d	18,43 bc	7,86 a
Dry weight plant	8,02 cd	10,03 d	6,89 bc	3,03 a
Number of mature seed	4,35 a	6,97 b	5,23 a	4,6 a
Number of empty seed	2,217 ab	2,717 bc	2,55 bc	1,717 a
Dry weight seed	2,505 a	4,169 b	3,108 a	2,670 a

Explanation : The treatment that have similar letter symbol are not significant in the same coloum.

From analysis of covariance obtained results not significant either research to kind of tillage, herbicide or interaction between variable weights of 100 dry seed of mung bean. Loomis and Connor (1992) said that each plant population found con formation between embryo's size, some of supply seed and support reduction supply seed and the characters genotype rate. So, weight of 100 dry seed depends on genetic factor and not influences by external factors. Each variety has its own characteristics. According to Suprapto (1993) one of the characteristic of mung bean number 129 is weight of 1000 seed not more than 65 gram.

From analysis of covariance result show that the interaction between tillage and kind herbicide not significant to all variable. These shows tillage have small influences to herbicide efectivity caused by well soil poreus so research tillage, unrepair penetration of herbicides into soil.

CONCLUSION AND SUGESTION

Conclusions

1. Roundup herbicides not significant to high plant, fresh weight plant, number of young seed, number of empty seed and weight dry seed mung bean.
2. Goal and Ronstar herbicide decrease plant high, fresh weight plant and not significant to number of mature seed, number of young seed, number of empty seed, number of dry seed, and weight of 100 dry seed mung bean. Ronstar herbicide not significant while goal herbicide decrease to dry weight mung bean plant.
3. Research tillage and interaction between tillage and kind of herbicide not significant to plant high, fresh weight plant, some of mature seed.

Sugestion

1. Roundup herbicide with dosage 1 litre/acre can applicated to control grass for mung bean.
2. No tillage can applicated to mung bean without decrease crop yield on low soil with well structure soil.

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