The Application of PGPR (*Plant Growth Promoting Rhizobacteria*) on Chili Plant as an interposed Plant between Salak Plant in Sub-District Srumbung

Ellen R. Sasmita, Sri Sumarsih, Oktavia S. Padmini dan Endah B. Irawati

Agrotechnology Department, Faculty of Agriculture
University of Pembangunan Nasional "Veteran" Yogyakarta
Jl. Lingkar Utara 104 Condongcatur, Yogyakarta
Email: ellensasmita@gmail.com

Abstract

Chili plant is one of the commodities grown as interposed plant because it has high selling values and stable that can be the source of extra money for farmers when their salak plants not producing after Merapi eruption in Sub-district Srumbung, District Magelang. Planting chilli becomes the choice because it harvest quicker and indirectly will help cultivating the land around salak plants. The application of PGPR will triggered the growth of chili plant element in absorbing hara. This research aimed to study the response of PGPR application to the growth and crop yield chilli. This research using partition divided factorials design that repeated for three times. For the major partition, the chili seed is immersed with PGPR consists of two cedar and for the peak partition, the frequency of PGPR basin consists of four cedar.
The result showed that the application of PGPR is able to increase crop yield chilli, growth and there is an interaction between soaking seed chilli and the frequency of watering PGPR, and the combination of best treatment is P1F2 (soaking seeds with PGPR and the frequency of watering the PGPR is for two weeks).

Keywords: chili, PGPR

Introduction

Salak plant is a staple crop that is grown in sub-district Srumbung district Magelang. Srumbung is the largest area in producing salak pondoh in Magelang, with one of the varieties preëminent produced is salak Nglumut. The problem faced by salak farmers are due to Merapi eruption the end of October 2010 is the impact of the heavy damage against the plantation of salak. Due to tampering with salak plantation, the Merapi eruption make the economic activity society declined because to salak couldn't give results like in the previous era, so farmers do not have their income from their salak plantation

This problem needs to get attention from various parties. One of the solutions in solving this problem is the effort of planting interposed crops. Annual interposed plant is a plant that is grown among a perennial plant that arranged regularly in form up straight. The cultivation of plants interposed on the land salak chosen as a solution to start the process of recovery kebun salak it is expected that farmers being productive back. The cultivation of plants interposed in the salak plantation is a new thing for the people in srumbung, so that it takes the process of the transfer of technology.

The planting of interposed crops with annual plants among plants can be a choice, because it can be harvested quickly and will indirectly cultivate the land around salak plants. Cultivation of the land to blend a layer of volcanic ash that resulted from Merapi eruption to the ground eradicates impermeable layer that interferes with the drainages land and will reduce puddle when it rains. Good drainage will dissolve the ingredients that cause the ground to be acerbic. Selected commodities as interchanged crops are the value plants and also stable, for example chili. Wati's finding (2004) about the cropping pattern of chili as the plant broke in at the village of salak plants among Sudimoro, Magelang, showed no adverse side effects to the growth and production of both crops. The expectation with the plant between farmers will have an additional source of income while awaiting the salak which became his life during these hangers can generate returns with a high productivity.

Chili is a plant genus Capsicum. Its fruit can be used as vegetables, herbs or drugs, depending on the intended use. Spicy chilli fruits are very popular in the community as the amplifier sense of food. In the food industry, chili powder extract used as the substation of pepper to arouse appetite and flavoring dishes, also used in the manufacture of herb medicines (pharmaceutical industry), industrial food coloring, mix ingredients on a variety of food and

beverage processing industry as well as the producer of essential oils (Cahyoo, 2003). In Indonesia the great chili differentiated into two groups, the large red chilli and chilli red curls. The striking difference between the two types of chili are on the shape of the fruit and spicy flavours. Big red chili fruit surface is smooth and had spicy taste, while the curly shaped chili is very spicy.

Strategy to increase the growth and results chilli is by using PGPR (plant growth promoting rhizobacteria) or rhizobacteria. Rhizobacteria is that bacteria that live and flourish in the vicinity of rooting plants. Rhizobacteria can serve as pacemaker of the growth of plants and as agens antagonistic to plant pathogen (Timmusk, 2003 in Taufik, 2010). The advantage of the usage of rhizobacteria is that, it has no danger or hazard side effects so that the environmental pollution can be avoided. Several species of rhizobakteria capable of increase of growth in plants genus-genus rhizobium, among others azotobacter, azospirilium, a bacillus, arthrobacter, bacterium, mycobacterium and pseudomonas (Biswas et al. , 2000).

Plant Growth Promoting Rhizobacteria (PGPR) is a group of bacteria that live and thrive well in soil that is rich in organic material (Compant et al., 2005 cit., Kamila et al., 2013). This bacterium is known to be active in the area of colonized plant roots and has three main roles for the plant, namely: (1) as a biofertilizer, PGPR is able to accelerate the process of plant growth through accelerating absorption of nutrient elements, (2) as biostimulan, PGPR can spur plant growth through the production of fitohormon, and (3) as bioprotection, PGPR protect plants from path ogen (Rai, 2006).

This research aims to know the effect of PGPR application on growth and yield of pepper plants and to determine the most appropriate PGPR application for crop growth and yield of pepper.

Materials and Methods

The research was carried out in the hamlet of Chili Lor Village Sub-district, Magelang Regency Srumbung Srumbung in August 2011 to February 2012 with an elevation of 501 m above the sea level. The type of soil is regosol volcanic ash. The materials and tools used is the chili seed CE 999; Rabbit manure; PGPR; Silver black plastic mulch (PHP); Urea, ZA fertilizer and KCl; Agrymicin/Agrept. The instrument used was a polybag for, measuring cup, ruler, tool trap pests fruit, analytic weights, ropes and bamboo.

This research is using split plot design factorials consisting of two factors with three deut.. As the main swath (play a plot) is soaking seed chilli with pgpr consisting of two cedar namely: p1: soaked pgpr and p2: no soaked pgpr. As a tenement (wro of the plot) is the frequency of watering pgpr consisting of four cedar namely: f0: no watered, formula one: once a week, watered f2: watered two weeks ago, and f3: watered three weeks ago. There are eight combination treatment.

Implementation research beginning with the chili seed nurseries, aims to provide a quality seed in sufficient quantities. Before the seeds are spread, first we need to select the good seeds. The next fed chilli seed treatment by soaking in a solution of PGPR with concentrations of 10 ml per liter of water for 1 hour. Then the seeds are stocked in polybags for the media, one polybag planting one seed, right in the middle of polybags as deep as 1-1.5 cm, then covered with thin soil again. After the seedlings reach age 25 days and has equipped 2-4 helaian leaves, seed began to be moved to the plantation.

Before seedlings are grown, the ground among plants salak has been treated first as deep as of 30 cm to the circumstances of being friable, more fertility and free from plants penganggu. Pangkasan the midrib salak that damaged because of eruption be programmed into the ground, next made bedengan rude. At the moment, land given lime agriculture with a dose of 1.5-2 ton / ha or 150-200g / meters. Bedengan made with long 12 m, and the height 120 cm wide 40 cm. Mix together manure a rabbit, cangkul back so as to unevenly with the ground. At this stage bedengan 've so, then given fertilizer inorganic urea, za, and kcl, each 200 kg, 600 kg and 350 kg. / ha, mix together evenly to a depth of 25 cm. Mulch with black plastic silver mounted black position overlooking the ground, will give a darker conditions against the media making it possible to grow better rooting; While the silver color facing out, it can reflect sunlight so that the amount of heat on the surface can be reduced and the reflection of light can help accelerate the loss of water vapor that is stuck to the surface of the leaves of the plant.

The hole on mulching made by pasting a pit mulching, in the range of transplanting 50 centimeters x 50 centimeters. The depth of a hole cropping made on a hole mulching by means of digging in the ground about 8-10 cm. Bibit to be planted selected beforehand, selected bibit a healthy and uniform its growth. Before seedlings are grown, bibit and polibagnya dipped in solution agrimycin / agrept by concentration of the 1.2 g4 / l water, intended to prevent pathogen

that may be developed in the field. Next plastic polibag opened, seedlings are grown and direct watered water until the conditions are moist.

A solution of pgpr mls made by concentration of the 5 per liter of water. The application of the treatment, pgpr carried out in accordance once a week, two weeks once and three weeks for until, ahead of flowering plants by means of a splashed as many as 2-1 glass aqua solution last to the region of rooting plants.

Maintenance activities executed is perempelan, penyulaman, pengajiran, fertilizing follow-up irrigation (as needed plant); weeding weed among bedengan and control pests disease (setting up something like flies bibit).

Harvest is carried out at the age of 90 days after planting, with intervals of 3-5 days. Picking is done cautiously so that new and young fruit flowers don't fall out, by way of a plucked fruit stalks are accompanied.

The observed parameters include high plants, high branches, while the emergence of flowers, fruit and fruit weight amount per plant per harvest. The Data were analyzed using yout observations range on the real level of five percent. To tell the difference between the influence of the treatment performed Multiple Range Test Duncan on a real level of five percent.

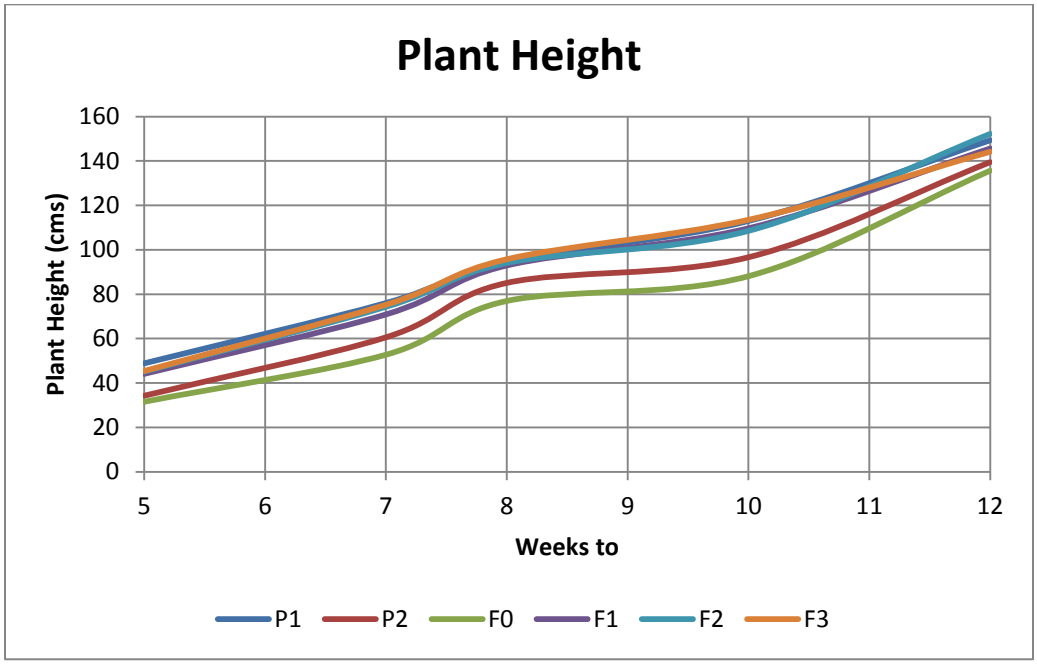
Results and Discussion

Plant Height of Chili

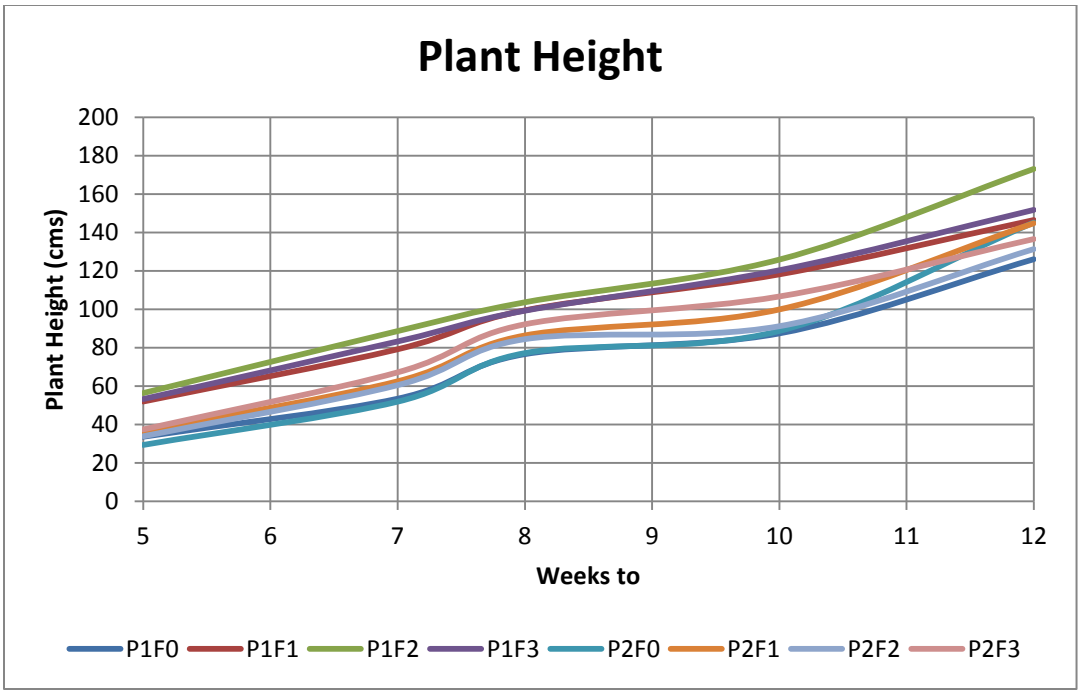
Based on the response of plant height of Chili, then it can be seen that the plant seeds are soaked in Chili PGPR (P1) and the seeds are not soaked PGPR (P2) shows a different plant. Plant that seed soaked with PGPR provide higher response. Soaking with PGPR gives the possibility for direct contact between the fitohormon with the seed-producing bacteria. So when the seeds germinate already affected by the fitohormon. Similarly on the plants watered with PGPR (F1, F2 and F3) showed higher plant height compared to plants that are not smothered with PGPR (F0) (graph 1). According to Suriadikarta (2011), as a result of the eruption the population of microbes use as soil enricher is down, so with the granting of PGPR can increase microbial populations. In addition, the setting of the seresah salak when tillage can also improve the organic material needed by the microbes.

The ability of PGPR produces fitohormon make the plant can increase surface area of fine roots and increase the availability of nutrients in the soil. Research results Masnilah et al., (2009), cit., Kamila et al., (1995), indicate that PGPR can improve treatment plant root growth of soybeans compared to the control treatment. This causes the absorption of nutrient elements and the water can be done well, so plant growth shown by its vegetation is also a good high.

On the graph of 2 visible that at combination treatment provides high response P1F2 a better plant than other treatment combinations.This means that the granting of PGPR two weeks once to plant chilli gives a better nutrient adequacy than the granting of PGPR one week or three weeks once in a while. On the frequency of watering once a week is likely to occur in conjunction with the imobilisasi seresah plant refurbishment process salak embedded at the time of processing land.



Graph 1. Chili Plant Height At Different PGPR Treatment

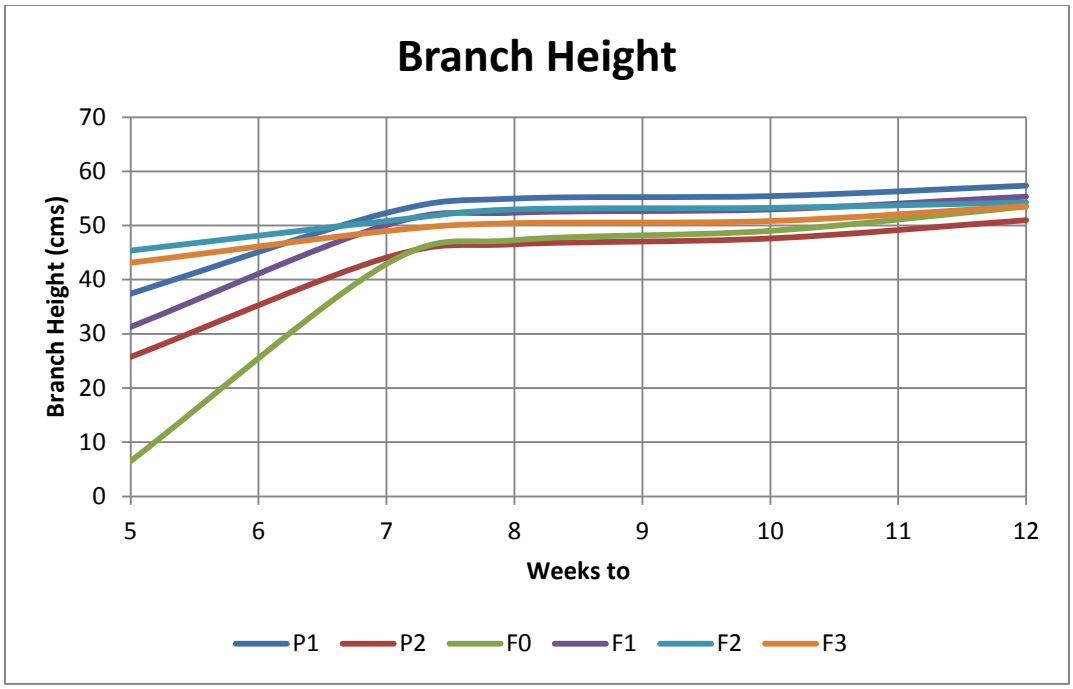


Graph 2. Chili Plant Height At Different Combinations Of PGPR Treatment

Branch Height

Based on high the branch of response against the use of pgpr then can see that high branches on the seeds of being soaked pgpr (p1) and seeds that are not soaked pgpr (p2) indicating high branches diverging. A plant whose seeds are soaked with pgpr give a response that higher. Similarly in plants flushing with pgpr (drives, f2 and f3) indicating high the branch of higher than plants that do not flushing with pgpr (f0) (a graph 3).

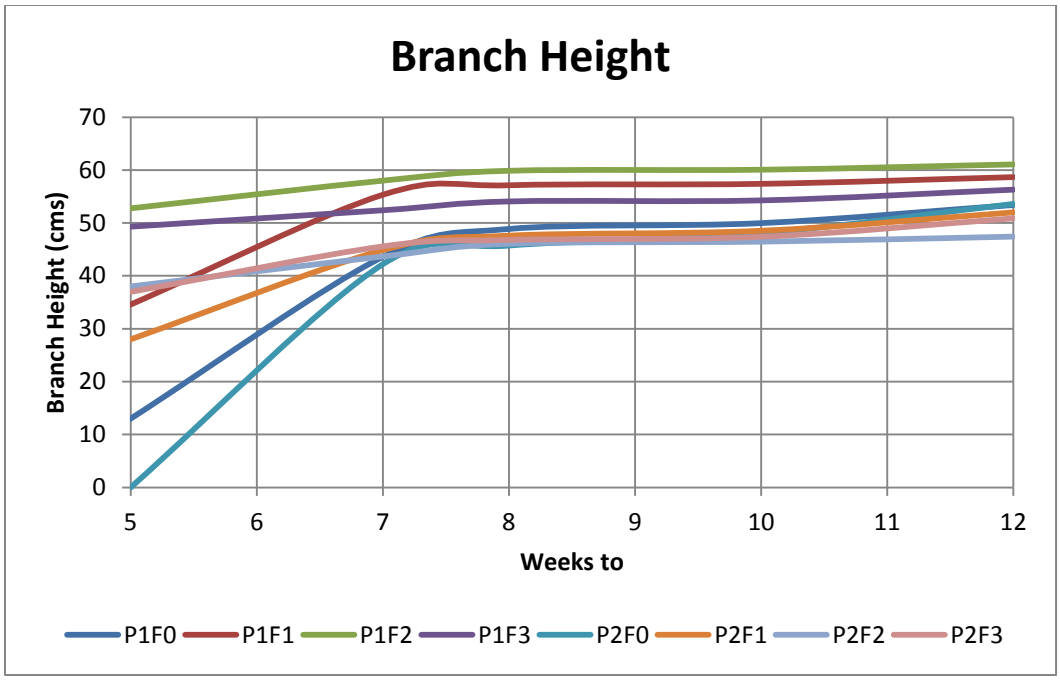
Pgpr improved plant growth hormones directly through growth produced as giberelin and iaa. Iaa growth hormone auksin group is useful to stimulate growth of plants. Auksin useful for stem cell, fueling growth the process of inhibiting pengguguran leaves cambium, and stimulate growth and hinder bud growth armpit (tjondronegoro et al. Cit, (1989). Kamila, et al. , 2013).



Graph 3. Branch Height On Different Treatment Of PGPR

On the graph 4 seen that combination treatment on P1F2 provide high response branch is better than other treatment combinations.This means that the granting of PGPR two weeks once to plant chilli gives a better nutrient adequacy than the granting of PGPR one week or three weeks once in a while.

The results of research conducted by maunuksela (2004) and thakuria et al. , (2004); showed that several groups rhizobakteria is as agens biodiversity that have the ability of a spur growth of crops. Rhizobakteri it is a native of a group of bacillus spp. , pseudomonas fluorescens and serratia spp. , which has been reported is able to produce hormone grow like iaa. According to taufik (2010), an research result of taufik et al. , (2005 and 2010), that can improve the application pgpr chilli growth of crops in the greenhouse. Inoculation agens biodiversity bacillus formis through treatment on seeds before transplanting can increase the growth of plants and the results of the peanut more than 19 % compared to controls.



Graph 4. Branch Height On Various Combinations Of PGPR Treatment

The emergence of flowers

On a table 1 following this can be seen that there is an interaction between treatment of soaking basin pgpr on the emergence of seeds and flower chilli. The appearance of flowers most quickly found in treatment p1f2, p1f3 and p2f2 which is 50 days after cropping, the three different from other treatment. Flowers appearing at most in treatment p1f0 and p2f0.

Observations show that the emergence of the generative flowers plants chili which is treated with PGPR faster than the control treatment. The role of PGPR in accelerating the emergence of interest allegedly related to his ability to synthesize the hormone grows Challenged and IAA are useful to stimulate the emergence of a flower.

Table 1. The average of the emergence of flowers chilli (days)

Treatment		Basin of PGPR (F)				Average
		F0	F1	F2	F3	
Soaking the seed (P)	Soaked (P1)	66,00 a	59,33 b	50,00 c	50,00 c	56,33
	Not soaked (P2)	68,47 a	60,00 b	50,00 c	59,33 b	59,45
Average		67,26	59,67	54,67	50,00	(+)

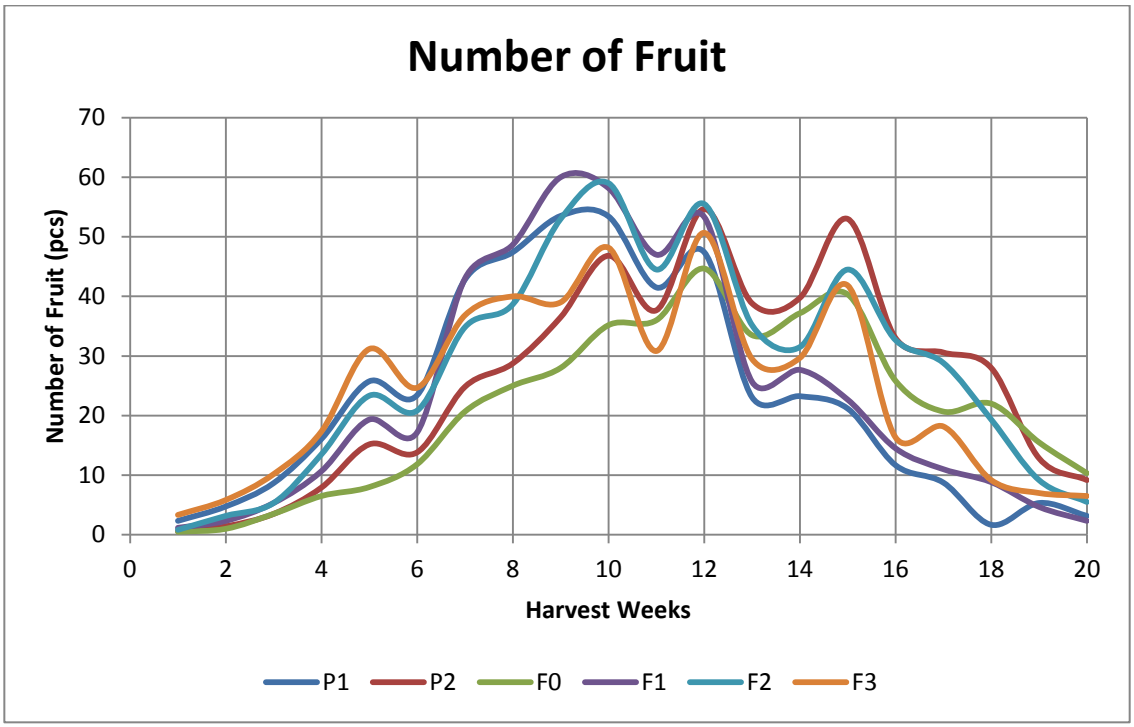
Information: figures in a column that followed the letter showed that there is no different real with the distance worship of idols duncan at the level of real five percent. (+): there is the interaction

The number of fruits and fruit weight

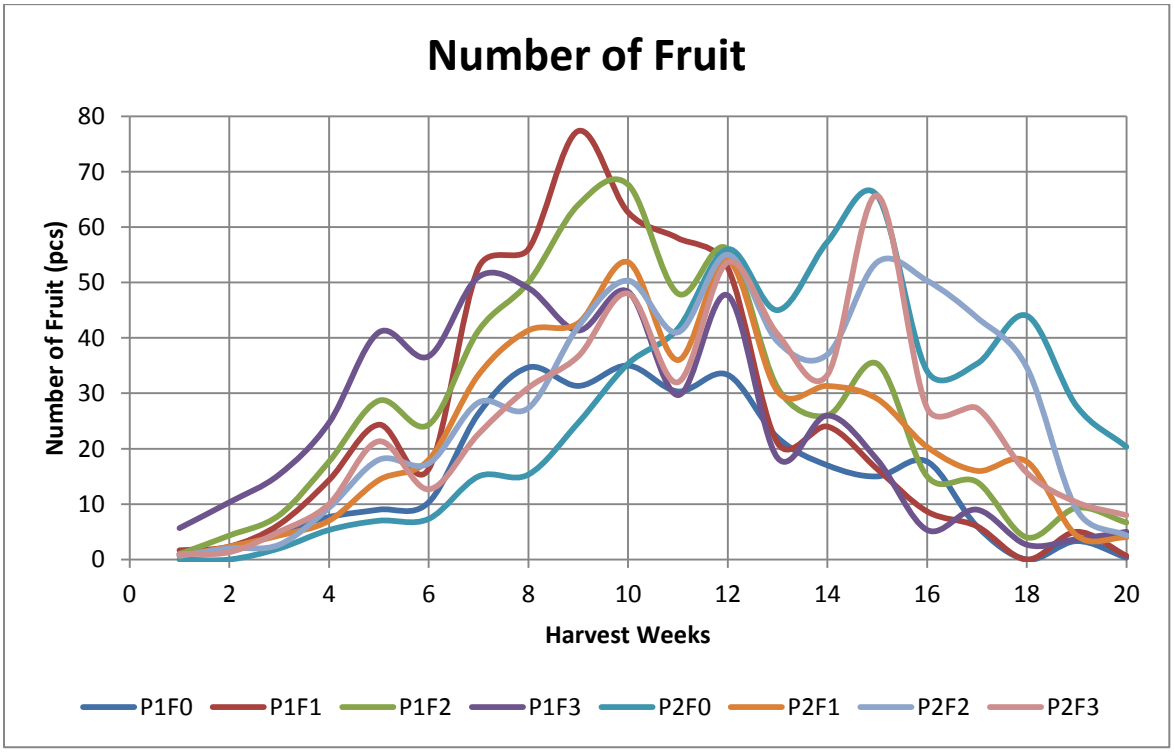
The results of observations on the number of fruit chilli (charts 5th and 6th) and weights fruit chilli 7th and 8th) (a graph showing the different treatment pgpr real treatment with control. Based on response number of fruits and fruit, weight then can see that treatment combination p1f1 treatment and p1f2 give the fruit and weights more and more heavily than combination other treatment. Results achieved in p2f0 lowest treatment. The number of fruits and fruit weight increased significantly at harvest 7th and fluctuates 15th, until harvest after the fruit harvest and weights on each decreasing. The highest attainable fruit fruit and weights at harvest 10th.

The application of pgpr able to increase the number of fruit and the weight of the fruit. Rhizobakteri used in plants pushes productivity plant better caused by the accumulation of nutrient as n and p and other compound that is induced by these microorganisms were. The application of pgpr can affect the production of fruit. A mechanism directly done by pgpr namely by means of a metabolite e.g. mensintesia compound that stimulates the formation of fitohormon as iaa (indole acetic acid), or by raising adoption of plant nutrition. Iaa is its active form of hormone auksin who be found in plants and played the role to improve the quality and yield harvest. The function of hormone iaa for plants among others, improve the development of the

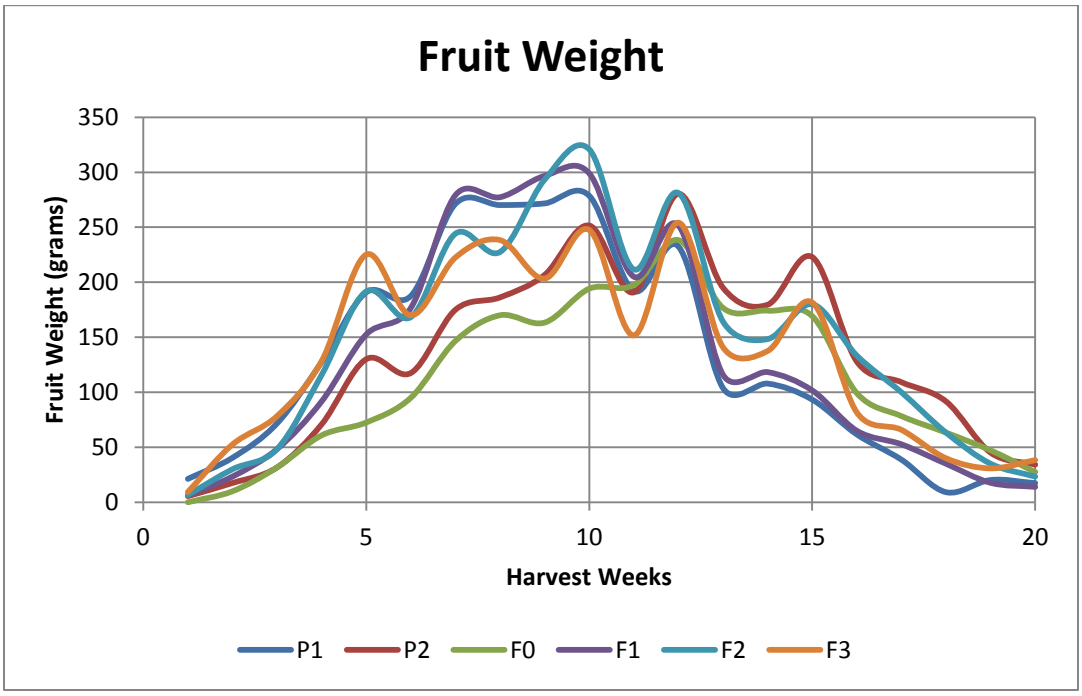
stimulates root formation of new spur growth, stimulates of flowering and increases the activity of an enzyme (arshad and frankenberger, 1993 tweet. , kamila (2013).



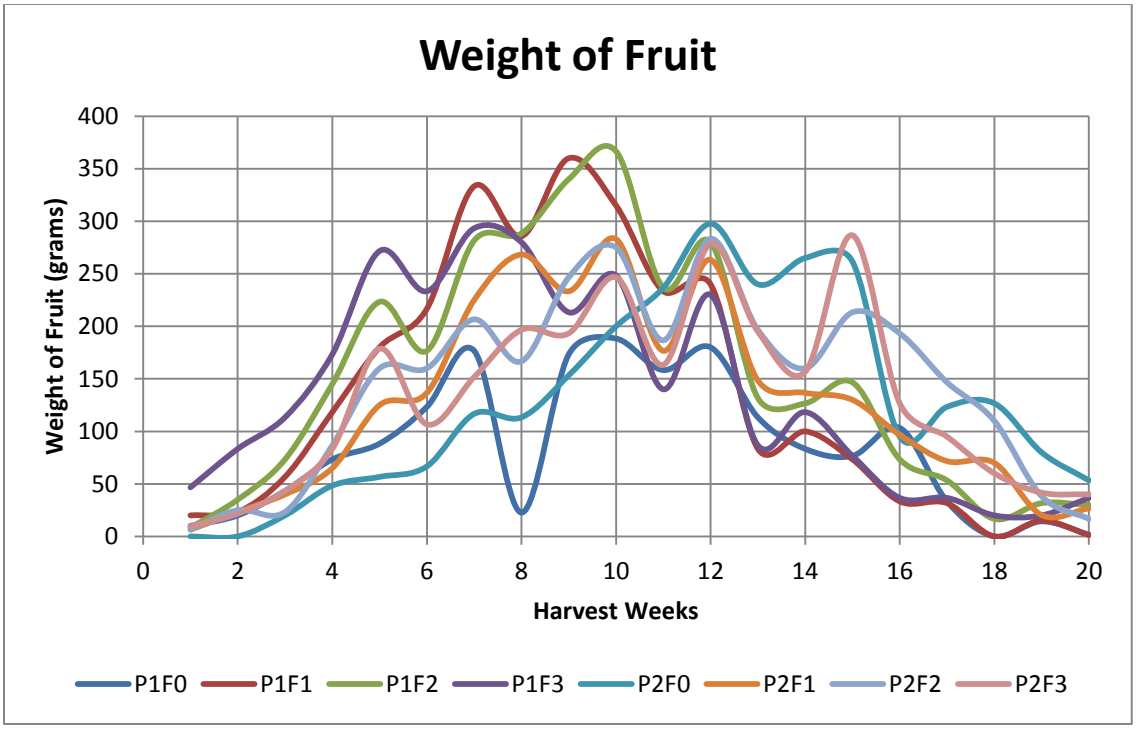
Graph 5. Number of Fruit On Various Treatment Of PGPR



Graph 6. Number Of Fruit On Various Combinations Of PGPR Treatment



Graph 7. Weight of Fruit on Various Treatment of PGPR pgpr treatment



Graph 8. Weight of Fruit on Various Combinations og PGPR Treatment

Conclusion

Based on the above discussion of the description can be retrieved the following conclusions:

1. Application of PGPR to improve growth and yield of chili plant
2. There was an interaction between seed soaking watering frequency with PGPR
3. The best treatment is a combination of P1F2 (soaking seeds wih PGPR and frequency of watering PGPR twice a week)

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