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Editorial Board

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Developing An Android-based Mobile Application for Temporary Animal Shelter Activities

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Abstract

With the rapid development of technology, studies on mobile devices have increased. By combining smart systems with mobile devices, mobile devices have gained simple computer functionality and have begun to simplify human life.

In this study, an Android-based mobile application has been developed in order to carry out activities related to the animals in the temporary animal shelter more effectively and easily. The system consists of two main components: web server and mobile application. The location of the animal shelter, information on the animal shelter, and data on employees and registered animals can enter this system. Data management has been performed independently from the application via web server. Records created on the website are reflected in the mobile application. The mobile application part has been developed with the Java programming language that can be used in the Android operating system for the use of local animal protection volunteers and community members. The application is based on location including the selection of provinces, districts, animal shelters. Thus, necessary activities related to temporary animal shelters can be carried out more effectively and easily.

Keywords: Android, Mobile application, Animal shelter

Research article

Accepted: 2 September 2019

INTRODUCTION

According to 5199 numbered Animal Protection Law in Turkey and the application regulations; temporary animal shelters should be established for the protection and welfare and rehabilitation of stray animals. The task of establishing animal shelters is given to local administration. Tasks such as vaccination, adoption, registration, monitoring and supervision policies were determined for these instituons (Anonymous, 2019a). The strengthening of social approaches to animal shelters is of great importance in terms of ensuring the successful functioning of animal shelters with the policies determined (Anonymous, 2018).

Today, technological developments in smart devices, the use of smart phones has become widespread. It has become necessary to present various information systems by sectors as mobile applications. Thanks to the software and hardware used with information systems, it is much easier for enterprises and institutions to fulfill the expected goals. With regard to the legal aspect, the storage of animal records for animal shelters makes it mandatory to perform with information systems and technologies their application responsibility in the policies determined for local governments.

In many countries of the world, training programs are organized at local level to control the population of animals (Anonymous, 2018). At the point of combating street animals, animals are placed in animal shelters and application policies for animal shelters are determined. The basic condition of getting on the way to protect the street animals is success in the implementation of the policies. Applied by local governments; The success of the registration of animals, adoption studies, monitoring and monitoring policies depends on local governments working in coordination with local animal protection volunteers and animal shelters. At the same time, this approach will enable the social approaches to be strengthened and will be able to form the infrastructure of the legal ground. For this reason; The development of an information system providing information on the registration of animals, animal shelters and details is of great importance for the implementation of the application policies in the responsibility of local administrations for animal shelters. The adoption rates of animal shelters may be increased by giving the local administrations the opportunity to create their own billboards for animals that are eligible for adoption. The system served by local administrations should also be served community members. This system can answer the questions such as the location of the nearest animal shelters, responding for help call of people, seeing the billboards for adoption and informing about activities of animals shelter. When the studies in this area are examined, there are some applications such as VETNET (Anonymous, 2019b) and HAYBIS (Anonymous, 2019c).

In this study, an Android-based mobile application for temporary animal shelter activities titled as "ShelterInfo" was developed. This application has been developed not only for local governments and local animal protection volunteers, but also for community members who want to have information about temporary animal shelters, who want to go to the nearest animal shelter and want to adoption from animal shelters.

MATERIALS AND METHOD

In the study, using the Linux kernel; The open source android operating system developed for smart devices by Google, Open Handset Alliance and free software communities has been used (Akalın, 2016). The data used were artificially produced coherently.

The Information, Adoption, Employees, Neutering Statistics menus are activated by selecting the animal shelters. The Adoption menu contains bulletin boards for eligible animals. Two methods have been identified to determine the location of the animal shelter. One is to have the user select the animal shelter details manually and the other is to use the location information to find the nearest animal shelter. According to the selection, the user can get directions to the animal shelter with the location permission. In the application, Android 6.0 Marshmallow version and API 27 level were used. It works successfully on Android 6.0 and above.

Representation of data in the application is provided by connecting the server with Android application side. Web site is prepared without direct connection to the server via the application and access to the database on the server with web service is provided. The Hypertext Preprocessor (PHP) file is linked to the MySQL database on the server. The connection between Anroid Application and server is provided by Java Script Object Notation (JSON) and the PHP page is converted to JSON format. Data from the web service were taken as json and the parse process was applied on the mobile application.

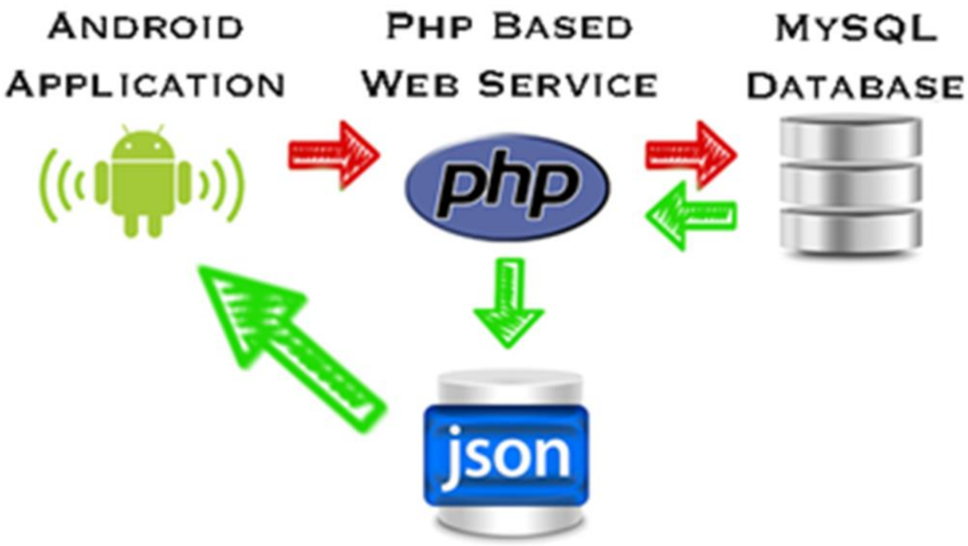

Figure 1. System architecture (Kaytaran et al., 2015)

The user side of the system works on two basic screens. In the system, there are two actors as mobile application and website user. Use case diagram of the system is shown in Fig. 2. The database is kept on a separate web server independent of the application. The user is able to access the parsed ready data from the application.

In this study, the architecture of the mobile application consists of 4 main components:

- Android mobile application developed for the use of community members
- Website for local government database records
- A remote server to manage and communicate the mobile application with the website
- A Database Management System (DMS) to store data on the server

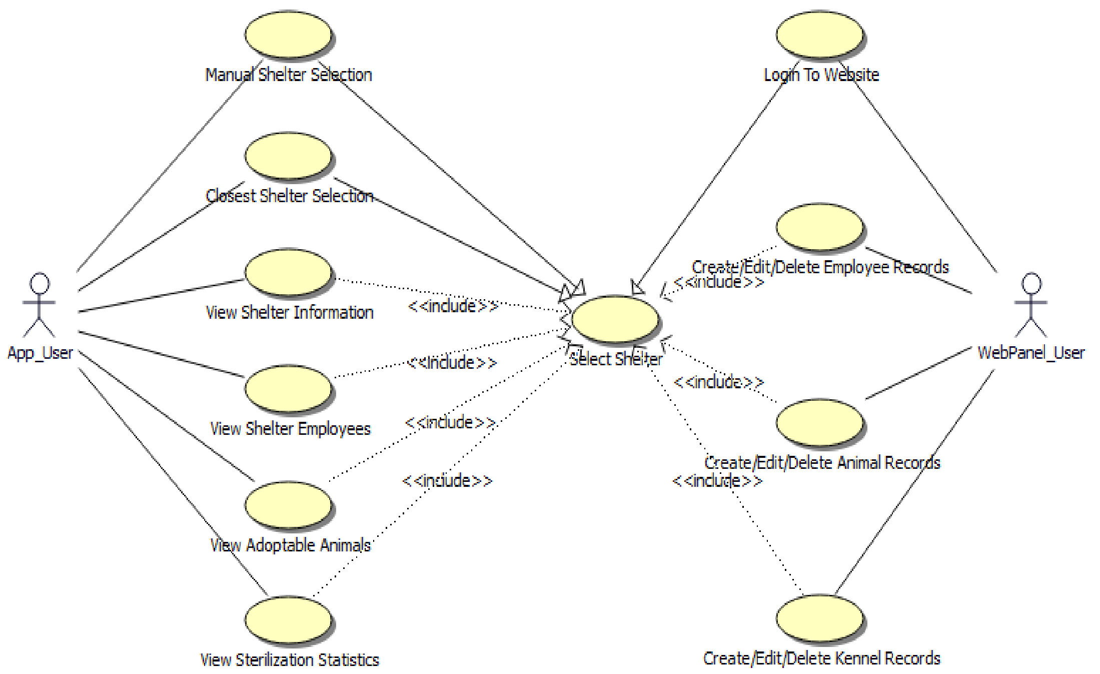

Figure 2.Use Case Diagram

Class structure developed in Android Studio editor of the system and methods are given in Fig 3. Adoption, Employees, Information etc on Navigation Drawer are coded as fragments run in MainActivity class.

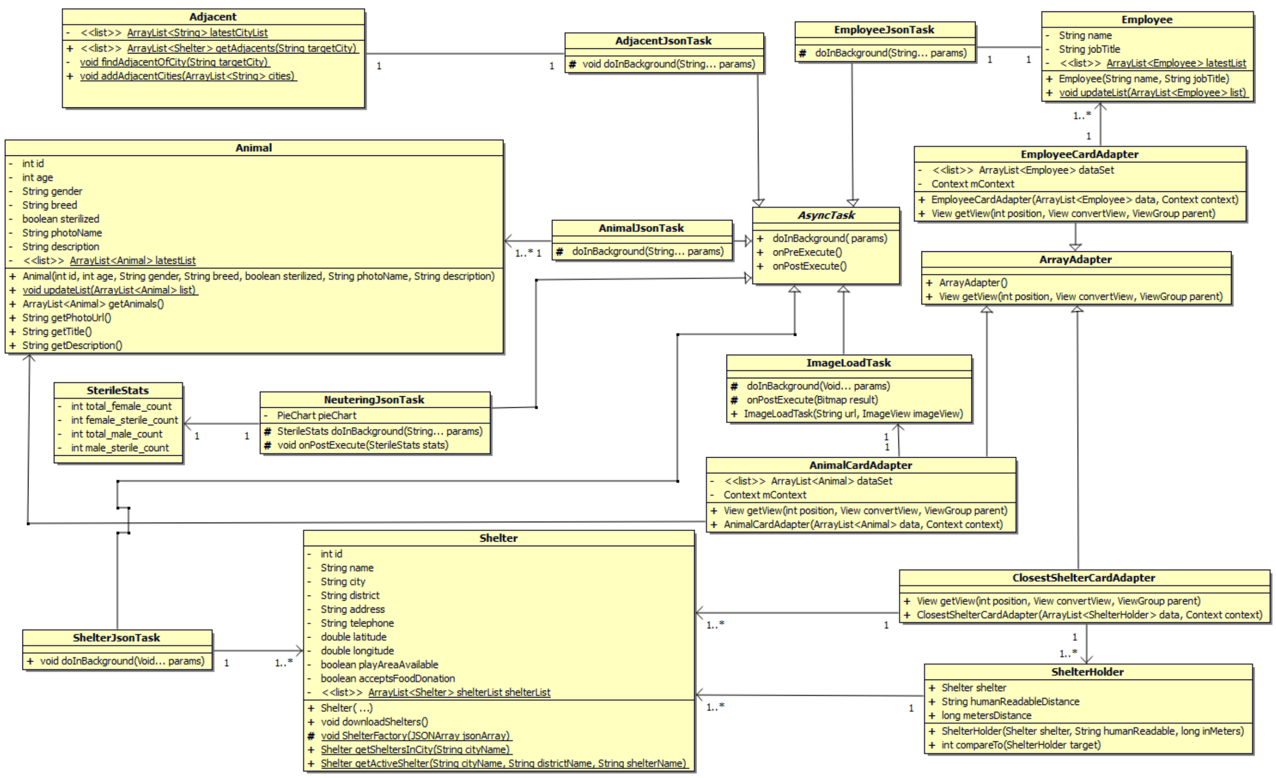

Figure 3. UML Class Diagram

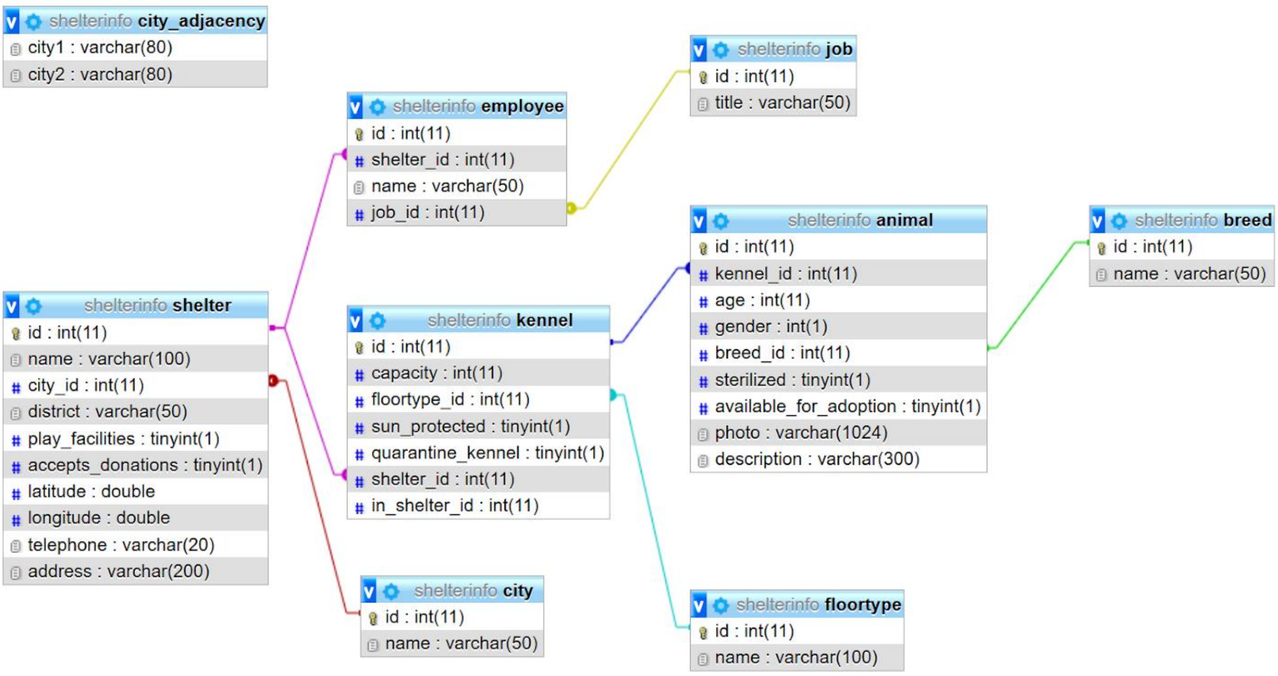

Figure 4. Entity Relationship Diagram

Entities created for animal shelters activities in the database on the server and the attributes of each entities are shown in Fig. 4. Information about the animal shelters, employees and jobs, floor type, sections/cages, animals and cities are stored in the database on the server.

RESULTS AND DISCUSSION

The system user side consists of two parts as specified.

- Website section to enter the animal shelter information for local administrations
- Android application section developed for the use of community members

Website

A website has been prepared for self-registrations of the animal shelters under the responsibility of local administrations. Mobile application has been updated according to website records. Every animal shelter can create their own databases through the website. In addition, all local administrations are able to provide users with the promotion billboards thanks to the mobile application. Animal shelter is primarily selected on the website screen. The registrations for the Home, Animals, Employees, Kennels menus are entered according to this selection. Read, Edit and Delete selections are included in the table for each record. Animal shelter workers can create records of employees, animals, cages/departments and prepare billboards on this website. Cage, strain, age, gender, description, photo, sterilization information can be recorded by entering the information in the table. In the Animal Details section, the information is transferred to the Adoption section in the mobile application for ownership if appropriate for the animal adoption (Fig. 5 and Fig. 6).

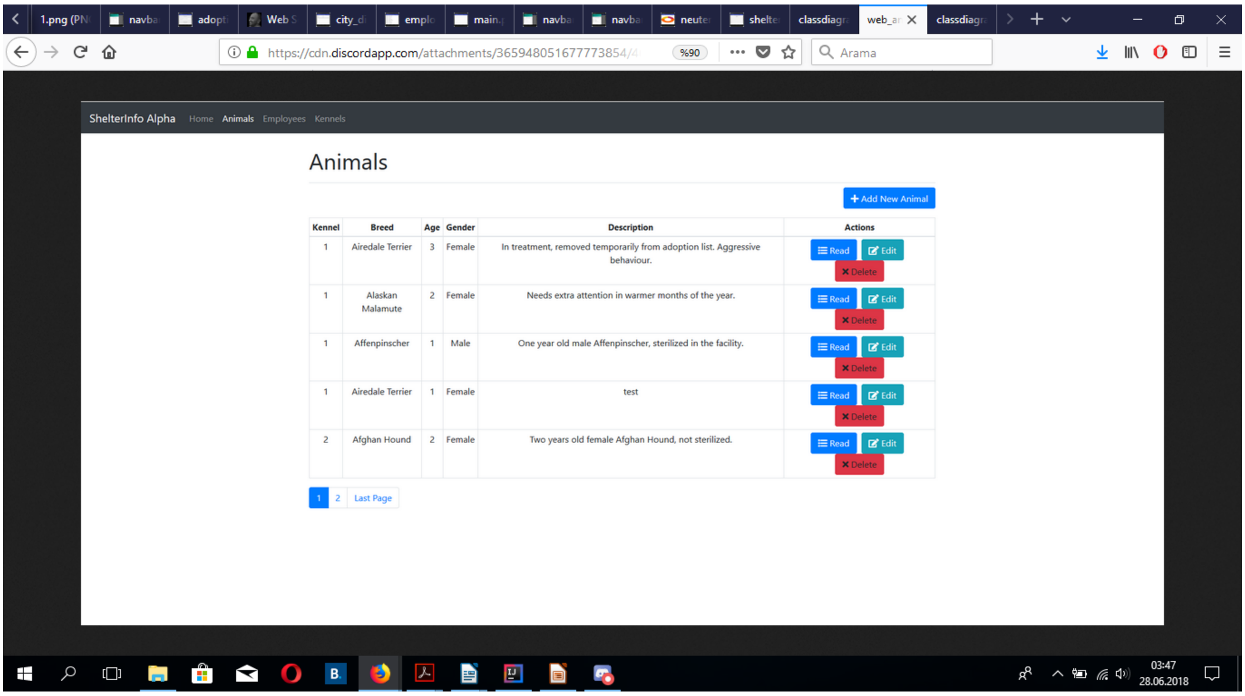

Figure 5. Webpage management panel

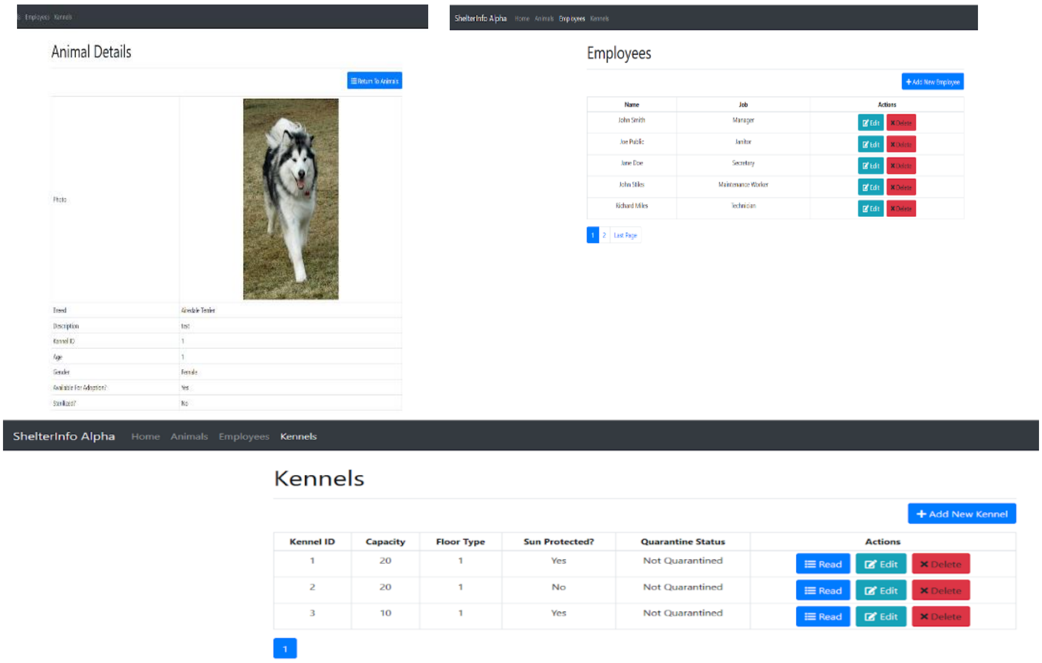

Figure 6. Menus on the website

Android Application

The application includes the following six basic headings (Fig. 6).

- City / District Selection
- Closest Animal Shelter
- Adoption

- Information
- Employees
- Neutering Statistics

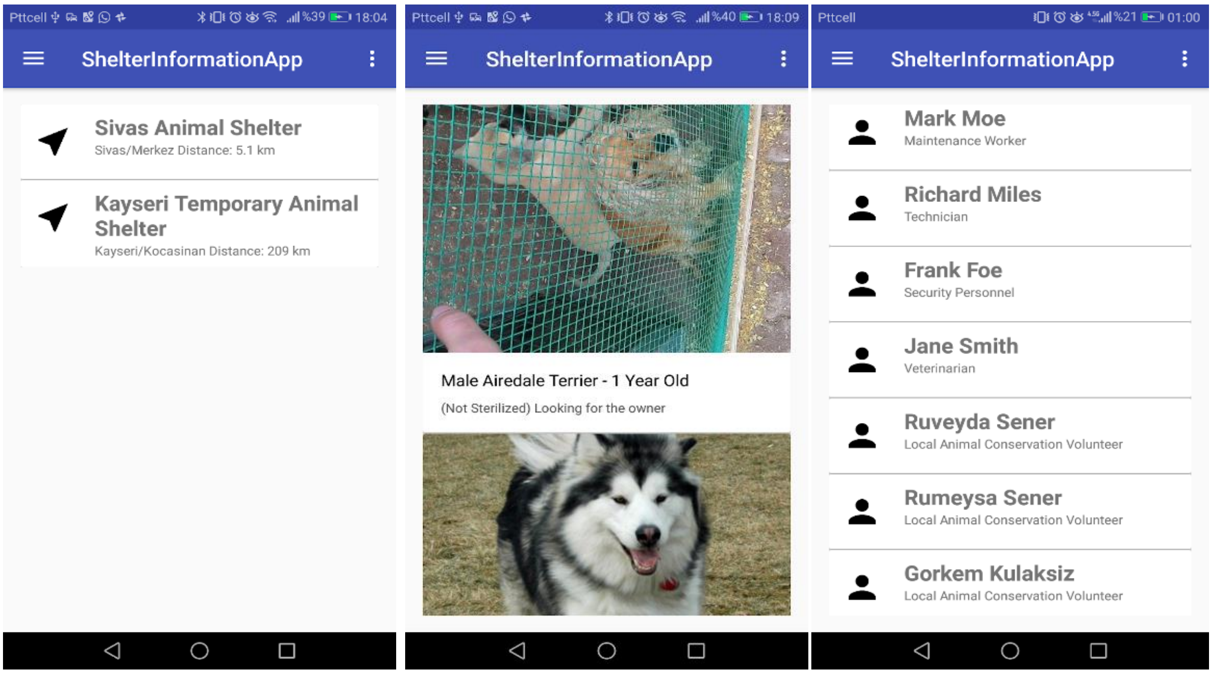

Figure 6. Functions on the mobile application

CONCLUSIONS

In this study, three basic structures were created as Web Server, JSON Parse and Android Mobile Application. The developed system was developed as a fully functional prototype android mobile application. The system works with all the functionality in Android 6.0 MarshMallow and above version. The application can be modified according to requirements for animal shelters. The application can be customized with user name and password. With the authorization of the local administration for the website, access to the records of the animal shelter units can be customized by entering the user name and password in the same way.

People who want to have an animal or get information about it always want to find answers easily from the internet environment. The fact that animal lovers can see the adopt billboard without going to a animal shelter helps them. Access via smartphones to the internet is one of their first choices. It makes their daily life easier for users to see the animal shelter, get routes, and find the nearest animal shelter in their call for help.

With the use of the application developed within the scope of this study, animal shelters application policies can be strengthened. Social approaches constitute the infrastructure of laws. The Law on Animal Protection will remain inadequate unless social approaches are strengthened. Topics such as perspective the stray animals in society and perpetration againist to animals should be revised. It should be aimed to prevent animal purchases by strengthening social approaches. Local administrations should adopt policy the adoption instead of purchasing for animals. Afterwards, monitoring and controlling should become one of the application policies of local governments.

ACKNOWLEDGMENT

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The Effects of Different Growing Mediums on the Root and Stem Development of Corn

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Abstract

This research was carried out to determine the effects of different growing mediums on dry and wet root weight, dry and wet stem weight, root and stem lenght of corn in the Soil Since Department of Agriculture Faculty, Atatürk University. In this research, pure materials of soil, pumice, perlite and torf, and mixtures of 50% + 50 %pumice + soil, 50 %+ 50 %perlite + soil, 50 %+ 50 %torf + soil were used as growing mediums.

As to the findings of this study; the effects of different growing mediums on the root and stem dry weight, root and stem length of corn were found to be statistically significant but root and stem weight nosignificant. According to the result, the highest valuees of dry root weight (0.78 g/pot), wet root weight (2.00 g/pot), dry stem weight (0.92 g/pot) wet stem weight (11.44 g/pot), root length (200 cm/pot), stem length (272 cm/pot) were obtanied from the pots in which pumice + soil 50 % + 50% was used. The lowest value were determined from the pots containing pumice, perlite and torf 100%. As a result, it was determined that the best root and stem development of corn was in 50% + 50% Pumice + Soil environment.

Key Words: Corn, Media, Root, Stem, Soil, Weight

Research article
Accepted: 15 August 2019

INTRODUCTION

Soils that can be used in plant production are both limited and variable. It is important that the soil which is the production medium in vegetable production has the desired physical and chemical characteristics such as proper drainage, adequate aeration conditions, optimum water holding capacity and suitable soil reaction together with useful moisture content. In order to provide the ideal conditions for plant growth in the soil environment, different organic and inorganic materials are used to regulate the physical and chemical properties of the soil.

In some studies carried out in different cultivation environments, pumice, which is mixed with soil, decreases plant water consumption, plant root and stem dry weight increased soil conditioners such as perlite and pumice in greenhouse conditions have a positive effect on the yield and yield components of carrot plant, soil, perlite, pumice, zeolite and mixtures thereof for barley. In the perlite medium, lower values of dry root weight than pumice are obtained the soil properties improved with the addition of pumice to the soil, and the best plant (strawberry) development was in the pumice environment mixed with the soil size between 4-8 mm and 45%. In another study, the stem diameter, number of leaves, seedling weight, seedling width, leaf length and leaf width of the best results, normal cibre + 25% super coarse perlite mixture; seedling size, rooted seedling length, root weight, rooted seedling weight and root length of the peat + 25% super coarse perlite mixture was determined (Karaman, 1993; Türk vd. 2003; Göçmen, 2005; Şahin et al. 2005 & Çinkılıç, 2008).

MATERIAL AND METHODS

The research was carried out to compare pumice, perlite and peat media using corn plant and to determine the optimum medium for plant root and stem development. Corn plant was chosen because of its hairy root formation. As control, soil is used and seven different cultivation media consisting of pure forms and mixtures of other materials were prepared. As a result, 100% Pumice, 100% Perlite, 100% Peat, 100% Soil, 50% + 50% Pumice + Soil, 50% + 50% Perlite + Soil, 50% + 50% Peat+ Soil have formed the cultivation media in research. The research was carried out as a pot experiment in Atatürk University Faculty of Agriculture Department of Soil Science. The experiment was conducted in three repetitions according to the pattern of fully randomized plots, in polyethylene black pots. Plants were planted as five plants in each pot, irrigation was done during the development period and no nutrients were given. Plants were harvested after seven weeks. The research results were statistically tested using the SPSS 13 package software, with variance analysis (ANOVA) and Duncan multiple comparison test (5%) (Dowdy & Wearden, 1983).

Research Findings and Discussion

Root Dry And Wet Weight (g/pot)

Plants obtain a large portion of the nutrients they need, from the environment in which they develop, with the under ground organs (roots) and a small portion of them, from the aboveground organs (stems, branches and leaves). For this reason root systems are of great importance in plants. Root system refers to all the roots of the plant. Root systems differ in terms of structure, weight, development and propagation under the influence of the environmental conditions in which plants grow, and in water and nutrient absorption, root tip is of vital importance in plant root systems.

The results of variance analysis and mean values of the root dry and wet weight values of corn plant grown in different growing media are given in Table 1. Media were found significant at 1% level in terms of root dry weight. Root wet weight was found to be insignificant. According to the Duncan multiple comparison test, the mean values of root dry weights fall into in three different groups and values of root wet weights fall into in two different groups (Table 1).

Table 1. Dry and Wet Root Weight of Plant Grown in Different Growing Media

Breeding Envıronments (%)	Root Dry Weight (g/pot)	Root Wet Weight (g /pot)
Pumice 100%	0.24 a	0.78 a
Perlite 100%	0.39 ab	1.11 ab
Peat 100%	0.35 ab	1.25 ab
Pumice 50 % + Soil 50 %	0.78 b	2.00 b
Perlite 50 % + Soil 50 %	0.73ab	1.83 ab
Peat 50 % + Soil 50%	0.30 ab	1.15 ab
Soil 100 %	0.55 c	0.75 ab
Envıronments	**	**

** $p<0.01$, * $p<0.05$, ns none significant

Stem Dry And Wet Weight (g/pot)

As can be seen in Table 2 the stem dry weight of corn plant grown in different growing media was found to be significant at 1%. While the number of stem wet weight was found to be insignificant. At the same time. the average number of stem dry and wet weight values fell into two different groups.

Table 2. Dry and Wet Stem Weight of Plant Grown in Different Growing Media

Breeding Envıronments (%)	Stem Dry Weight (g/pot)	Stem Wet Weight (g /pot)
Pumice 100%	0.59 a	6.49 ab
Perlite 100%	0.91 a	4.73 a
Peat 100%	0.93 a	8.43 ab
Pumice 50 % + Soil 50 %	1.09 a	13.48 b
Perlite 50 % + Soil 50 %	0.69 a	7.99 ab
Peat 50 % + Soil 50%	0.55 a	5.99 ab
Soil 100 %	0.83 b	4.4 ab
Envıronments	**	ns

** $p<0.01$. *$p<0.05$. ns none significant

According to the results. highest stem dry weight (1.09 g/pot) values and stem wet weight (13.48 g/pot) values were recorded in 50% Pumice + 50% Soil medium while the lowest value was found in the 50% Peat + 50% Soil medium (0.55 g/pot) and Perlite 100 % (4.73 g/pot). In medium with perlite or perlite + soil mixture. soil is not hardened. contact between root and soil increases and consequently adequate porosity is provided for plant root and stem development and of roots and stem length increases. Because of the excess water retention capacity of the peat medium. plant roots are thought to rot.

Sahin et al. (2005) found that the number of leaves, leaf area, dry and fresh root weight, root length and fresh weight were positively affected by different ratios of pumice in strawberry plant.

Root and Stem Length (cm/pot)

The variance analysis results and mean values for the root and stem length of corn plant grown in different growing media are given in Table 3. While root and stem length values were significant at 1% level. According to the Duncan multiple comparison test root and stem length values fell into two different groups.

Table 3. Root and Stem Length Values of Corn Cultivated in Different Growing Media (cm/pot)

Breeding Envıronments (%)	Root Length (cm)	Stem Length (cm)
Pumice 100%	200 a	194 b
Perlite 100%	297 b	191 b
Peat 100%	312 b	195 b
Pumice 50 % + Soil 50 %	328 b	272 b
Perlite 50 % + Soil 50 %	198 a	265 b
Peat 50 % + Soil 50%	188 a	245 b
Soil 100 %	110 ab	103 a
Envıronments	**	**

** p<0.01, * p<0.05, ns none significant

The plant needs macro and micropores for root development. Root growth decreases as the oxygen content of soil air drops below 8%. and when it is less than 2% growth stops. Root development and elongation decrease significantly in soil which is compressed. whose volume weight increased and pores lost for any reason. Root growth is adversely affected at low temperatures and the formation of lateral roots retards (Anonymous, 2018). Root growth and development in plants are closely related to soil texture. In addition to clay layer. rocks etc. which are to be found in any part of the soil, the height of the groundwater level and the lack of plant nutrients significantly limits the root growth. Plants generally form thinner and deeper roots with more lateral branches in sandy soils compared to clayey soils. In this study it is thought that the use of soil with clay-loam texture, the high water retention capacity of perlite and peat media could negatively affect the length of roots and stem.

Celik (2009) found that the best rooting medium was peat+perlite in the research using sand, peat, perlite and blends of these media. In another study where the quality of fig plant was determined, soil, forest soil, perlite, pumice, zeolite and their mixtures were used as the growing medium and it was noted that best root length values were obtained in perlite + zeolite medium and the best root number values in the pumice medium (Ertan et al. 2007).

CONCLUSION

According to the results of the research. It was found that the most effective medium on dry and wet root weight, dry and wet stem weight, root and stem length of corn was found to be mixed perlite medium among the different media used for root and stem development.

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Effect of Phosphorous Fertilizer and Bacterial Applications on Seed Yield of Morphologically Different Forage Pea (*Pisum sativum L.*) Varieties

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Abstract

As a result of today's modern agricultural practices, many negative consequences have been encountered due to the use of intense, inaccurate and excessive chemical fertilizers and pesticides. In particular, chemical fertilizers have reached fresh water sources as a result of washing, causing environmental pollution and this has become a threat to human, domestic and wildlife. Therefore, one of the alternatives created by experts in terms of prevention of environmental pollution and agricultural sustainability has been the use of useful bacteria instead of chemical input.

In this study, carried out in Erzurum, was aimed to determine the effects of different phosphorous rates (0, 30 and 60 kg/ha P_2O_5) and bacteria genotypes (control, nitrogen fixing and *phosphate solvent*) on agricultural and morphological characteristics of some fodder pea cultivars. The experiment was established in Randomized Split Blocks Trial Design with three replications. In the study, were used Kirazli (semi-leafless) and Urunlu (leafed) pea cultivars, *Rhizobium leguminasorum* and *Arthrobacter agilis* bacteria and triple superphosphate 0-45-0 fertilizer. According to the results, number of pods per plant 6.5-7.7, number of seeds per pod 5.6-6.2, 1000 seed weight 187.5-198.9 g, seed yield 1087-1663 kg/ha, seed crude protein content 30.6-31.6 % were investigated. As a result; no response was observed for phosphate fertilization since the soils of experiment plots were rich of this nutrient. Yet, *Rhizobium* inoculation yielded positive and significant results.

Keywords: Bacteria inoculation, environmental pollution, forage pea, phosphate rates, variety, yield components

Research article
Accepted: 21 August 2019

INTRODUCTION

As a result of today's modern agricultural practices dense, incorrect and excessive chemical fertilizers and pesticides use as a result of various negative consequences. Especially chemical fertilizers reach to fresh water sources as a result of washing and cause environmental pollution.This situation negatively affects people and the environment in which they live. Environmental pollution should be prevented and agricultural sustainability ensured natural resources must be protected. Environmental and life-friendly techniques and applications should be developed and investigated as an alternative to the use of chemicals.

Recently, studies to increase the availability of phosphorus with different bacteria have gained momentum. Plant growth, nitrogen fixation, phosphorus to become bioavailable, some minerals taken by plants, production of some hormones that promote the growth of bacteria can be used in the plant. In this study, the effects of phosphorous bacteria and phosphorus solvent bacteria (*A. agilis*) and nitrogen fixation (*R. leguminasorum*) on seed yield and yield components in different morphology (semi-leaf and normal leaf) varieties were investigated.

MATERIAL AND METHODS

As material; two different types of feed peas Type of half-leaf (semi-leafless) (Kirazli) Type of full-leaf (leafed) (Urunlu) nitrogen fixative (*Rhizobium leguminosarum*) phosphorus solvent bacteria (*Arthrobacter agilis*) three doses of phosphate fertilizer (0, 3 and 6 kg / da P_2O_5) were used. Research; in Erzurum, Eastern Anatolia Agricultural Research Institute was conducted with three replicates according to the Randomized Split Blocks Trial Design with three replications. In the experiment, the plantings were made in 5 rows of 5 m in row spacing of 20 cm. While the varieties (2) were placed in the main parcel, 3 (0, 3 and 6 kg / da P_2O_5) and bacteria 2 (inoculated-noninoculated) were placed in the sub-parcel. The plantings were made by hand on May 5 each year. A few hours before planting, the seeds were wetted with sugar water and then mixed with the bacteria culture (*Rhizobium leguminosarum* (RL). *Arthrobacter agilis* (AA) inoculation was done before planting in the Department of Plant Protection, Faculty of Agriculture, and Ataturk University. Half of the parcels were harvested for the weed and half for the seed. The data obtained in the study were used by SPSS computer package program. Analyzes of the variance of years divided parcels, the combined analysis was made according to the split plot design, significant factor averages were grouped by Duncan test.

Soil properties of the research area; soil samples taken from the first year research area; clay loam, slightly alkaline reaction, organic matter content less, moderately salty, rich in potassium and phosphorus level was determined to be sufficient. In the second year analysis results; clay loam, mild acid reaction, poor organic matter, limy, without salt, ıt has been found to be rich in potassium and phosphorus.

In the first year of the study, the temperature value (12.6^oC) in vegetation period is lower than the average. In the second year it was slightly higher than the average (14^oC) for 14 years with 14.8^oC. The second year was hot in the summer months (Figure 1).

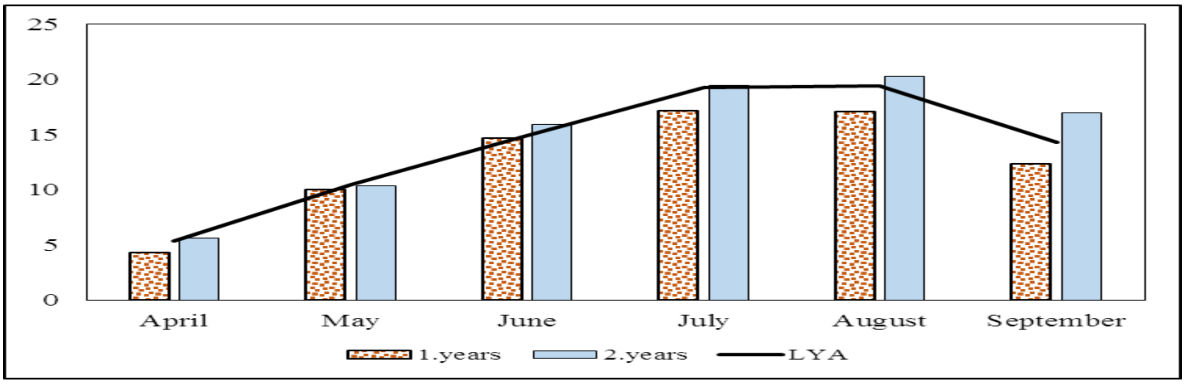

Figure 1.Temperature of research years and long years average

In the first year of the survey, the total amount of precipitation was above the average of 257.8 mm. In the second year, the total amount of precipitation was above the average of many years (241.6). The first year of June 22 and the second year of June 16 and July 18 there was heavy rain and hail. The first year was quite a lot of rainfall in June (Figure 2).

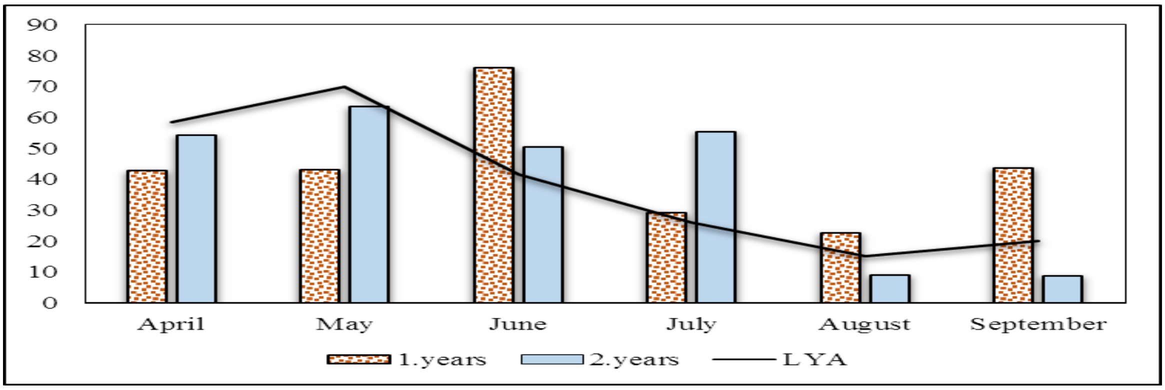

Figure 2. Rainfall values for years of research and long years average

Research Findings and Discussion

According to the results of this research; There were no significant differences between the number of grains in bean, the weight of one thousand grains and the rate of crude protein. In the first year in terms of the number of pods in the plant phosphorus and bacterial applications with the effect of phosphorus x bacteria, phosphorus x variety, bacteria x variety and variety x phosphorus x bacterial interactions were statistically significant at 1% level. In the second year, application of bacteria was 1% and phosphorus application was significant at 5% level. Interactions of the variety x phosphorus interaction was found to be significant at 5%. It was noted that phosphorus and bacterial applications were very important in the combined analysis of years ($p<0.01$). Variety diversity was significant at 5% level. In the study the yield components examined;

Number of pods in the plant

In the first year of the experiment, the average number of pods per plant was 7.0 for Kirazli and 7.2 for Urunlu. Pea plants in the parcels containing phosphol solvent bacteria produced more pods than the plants in the parcels where RL inoculated was performed. In the first year of the experiment, the number of pods in the plant has not been affected by bacterial applications. In applications where phosphorus is applied, especially in *A. agilis*, there is a significant increase compared to control. In the first year in the non-phosphorus parcels less per plant per plant (6.4) was determined, while phosphorus applied in the more pods were identified (Table 1).

Varieties in the first year of the experiment showed different results against bacterial applications. Kirazli variety is the highest value of AA application, while the Urunlu type RL + AA application has reached. In the second year of the experiment, the average number of pods in the plant was 7.4 and the number of beans was 7.3 and 7.2, respectively. The plants in the phosphorus applied parcels have a higher number of pods per plant than the ones without phosphorus (Table 1). The difference between phosphorus applications was significant ($p < 0.05$). Kirazli varieties of 3 kg P_2O_5 applied to the parcels more varieties per plant than the varieties of varieties, while In other phosphorus applications, the Urunlu type has similar or higher values. In bacterial applications, the plants in the parcels where RL and AA bacteria were applied alone produced more pods than in control and RL + AA parcels. In the combined analysis, there was no significant difference in the production of pods per plant. The number of pods per plant, which was 7.0-7.4. The number of pods per plant was 7.1 in Kirazli cultivar and 7.4 in Urunlu cultivar. The plants in the phosphorus applied parcels produced more pods than the ones without phosphorus. A significant difference ($p < 0.01$) between phosphorus doses was found in the combined analyzes.

Table 1. The average number of pods per plant for the peas applied to bacteria and phosphorus fertilizers (number)[1]

Varieties	Years	P_2O_5	K	RL	AA	RL+AA	Average
Kirazli	1.year		6.4	6.4	7.8	6.5	6.8
	2.year		6.3	7.6	8.0	7.2	7.3
	Two years	P0	6.1	6.1	7.5	6.1	6.5
		P1	6.4	7.7	7.4	8	7.4
		P2	6.7	7.1	8.9	6.6	7.3
		Average	6.4	7	7.9	6.9	7.1 b
Urunlu	1.year		6.3	7.2	7.0	8.2	7.2
	2.year		7.1	7.9	7.9	7.3	7.6
	Two years	P0	6.7	7.1	7.6	6.5	7
		P1	6.7	7.6	7.7	8.2	7.6
		P2	6.8	8	7.2	8.7	7.7
		Average	6.7	7.6	7.5	7.8	7.4 a
Two years	Average	P0	6.4	6.6	7.6	6.3	6.7 B
		P1	6.6	7.7	7.6	8.1	7.5 A
		P2	6.8	7.6	8.1	7.7	7.5 A
	Average	Average	6.6 B	7.2 A	7.7 A	7.4 A	7.2

[1] The averages marked with different uppercase and lowercase letters are important at 1% and 5% respectively.

Plants in the P2 applied parcels produced 7.2 to 7.7 pods per plant. While phosphorus applications in control plots did not affect the number of pods in the plant, phosphorus fertilization increased the number of bacteria in RL and AA applied parcels. Bacterial applications have led to the production of more pods in feed peas. There was no significant difference between varieties. This situation can be explained by the fact that there is no significant difference in the number of pods among the varieties. Similar results were obtained in similar studies (Tamkoc, 2007). Phosphorous fertilizer application caused a significant increase in the number of pods per plant in both year and unified analysis. A similar situation occurred in phosphorus-soluble bacteria. Although the soil of the trial area is sufficient for the phosphorus suitable for the plant, the phosphorus and phosphorus solvent bacteria have been reacted in terms of the number of pods. Here, phosphorus can promote the generative development of the plant (Yildiz, 2008). Since the activity of microorganism is low at the beginning of development, soil temperature may have played a role in the emergence of reaction to additional phosphorus or phosphorus solvent bacteria.

Number of seeds in the pods

In both years of the experiment, there was no significant difference between the varieties in terms of number of beans. In the first year, the number of beans in the varieties of Kirazli 6.6 pieces of the Urunlu has been 6.3 in number. These values in the second year of the trial Kirazli varieties of 5.4 and 5 was the Urunlu variety. In the second year, the Urunlu variety reached only the highest number of beans in the parcels (6.3) and the Kirazli variety reached the control parcels (Table 2).

In the second year of the experiment, the number of grains in the pod may have been in the drought of effective (Figure 3). In several studies, the number of pods and number of pods in the plant decreased due to drought (Ney et al. 1994; Guilioni et al. 2003). In the combined analysis, the genetic potential of the varieties has been influential in the variation in the number of seed in the pea among varieties (Table 2). According to the varieties, the number of seed in the number of pea changes (Tamkoc, 2007) was recorded by. The sufficiency of soils in the phosphorus direction may be effective in the reaction of phosphorus to the number of grains. On the other hand, the basic determinant in the presence of enough nutrients to determine the number of pea in plants is the drought (Davies et al. 1985; Biarnes-Dumoulin et al. 1996; Kocacaliskan, 2004; Uzun et al. 2005). In the second year, the decrease in the number of pea in the bean has been important because of the more drought of the generative period. Varieties have reacted differently against bacterial applications. The varieties with the highest number of varieties in the parcels applied to the AA, Kirazli RL + AA in the parcels were applied together. Bacterial response to the plant species, and even the same type of reaction to cause a different response (Lucy et al. 2004; Khalid et al. 2004) was effective in this regard.

Table 2. The average number of seeds per pod for the peas applied to bacteria and phosphorus fertilizers (number)[1]

Varieties	Years	P_2O_5	K	RL	AA	RL+AA	Average
Kirazli	1.year		6.5	6.9	6.4	6.9	6.6
	2.year		5.8	5.4	5.0	5.4	5.4
	Two years	P0	6.5	6.1	6	6.1	6.2
		P1	6	6.5	5.8	5.7	6
	Average	P2	6.1	5.8	5.4	6.7	6
		Average	6.2	6.1	5.7	6.2	6.1 A
Urunlu	1.year		5.9	6.4	6.5	6.5	6.3
	2.year		4.5	4.8	5.5	5.2	5.0
	Two years	P0	5.2	5.6	6.3	5.7	5.7
		P1	5.2	5.5	5.7	6	5.6
		P2	5.4	5.8	6	5.9	5.8
		Average	5.3	5.6	6	5.9	5.7 B
Two years	Average	P0	5.9	5.9	6.2	5.9	5.9
		P1	5.6	6	5.8	5.9	5.8
		P2	5.8	5.8	5.7	6.3	5.9
	Average	Average	5.7	5.9	5.9	6	5.9

[1] The averages marked with different uppercase and lowercase letters are important at 1% and 5% respectively.

Seed Yield

In the first year of the experiment, Kirazli cultivar yielded 216.9 kg of seed yield and 154.8 kg of seed yield. Although the seed yield in the range of 179.1-192.2 kg/da against phosphorous fertilizer applications was not statistically significant, similar results were obtained against bacterial applications. Although the highest seed yield was found in RL with 196.0 kg / da, it was not statistically significant. Kirazli variety in terms of seed yield was more efficient than the Urunlu variety.

The seed yield in the leaf-reduced varieties is the main selection criterion. In this study to, the genetic structure of this type has been effective in producing of semi-leaf Kirazli variety. Temperature and hail precipitation values recorded in the second year of the experiment caused a significant decrease in seed yield. High temperatures in the generative period cause a serious decrease in seed yield.

Seed yield per decare was 109.5 kg in Kirazli varietes. In the second year, the average seed yield of 90.9 kg ranged from 88.1 to 95.4 kg/da according to phosphorus applications. When the effect of PGPR applications is examined, it is seen that the highest seed yield occurs in RL vaccinated parcels (104.0 kg/da) and the seed yield is 99.4 kg/da in seed parcels (77.9 kg/da). It is seen In the second year of the trial, Kirazli variety produced more seeds than the control with RL application. On the other hand, seed yield per unit area in AA applications led to a faster decrease in the Urunlu variety. This situation led to a significant interaction of bacterial-type interaction. In the first year of the experiment, seed yield of 185.9 kg/da decreased rapidly in the second year to 90,9 kg/da. This decrease was statistically significant on a yearly basis ($p < 0.01$). In the combined analysis, the average seed yield was 138.3 kg/da. In Kirazli variates, 163.2 kg / da in the variates and 113.4 kg/da (Table 3).This has made the difference between the varieties statistically very important.

Table 3. The average seed yield for the peas applied to bacteria and phosphorus fertilizers (kg/da)[1]

Varieties		P_2O_5	K	RL	AA	RL+AA	Average
Kirazli	1.year		173.5	240.7	210.2	243.3	216.9
	2.year		108.9	119.8	110.5	98.9	109.5
	Two years	P0	139.9	178.8	152.4	162.9	158.5
		P1	139.2	181.0	172.2	172.7	166.3
		P2	144.6	180.9	156.3	177.7	164.9
		Average	141.2	180.2	160.3	171.1	163.2 A
Urunlu	1. year		166.0	151.2	168.0	133.9	154.8
	2. year		89.8	88.3	45.4	65.4	72.2
	Two years	P0	132.3	108.5	107.9	86	108.7
		P1	127.9	131.9	108.5	116.9	121.3
		P2	123.4	118.7	103.5	95.8	110.4
		Average	127.9	119.7	106.6	99.6	113.4 B
Two Years	Average	P0	136.1	143.7	130.2	124.5	133.6
		P1	133.6	156.5	140.4	144.8	143.8
		P2	134	149.8	129.9	136.8	137.6
	Average	Average	134.6	150	133.5	135.3	138.3

[1]The averages marked with different uppercase and lowercase letters are important at 1% and 5% respectively.

In both varieties, seed yield decreased in the second year of the experiment compared to the first year. However, the decrease in the Urunlu variety was more pronounced compared to the decrease in the Kirazli variety. In general, pea seed yield is reported to vary between 150-200 kg/da (Bayraktar, 1981; Gençkan, 1983; Alan, 1984). Seed yield in the first year of the trial is observed to be very good in the second year. However, it is observed that seed yields are consistent with the literature as the average of both years (Tosun, 1974; Alan, 1984; Altın, 1991; Acikgoz, 2001; Sayar et al. 2009; Tan et al. 2009).

In the first year of the experiment, a positive response was recorded in the Kirazli cultivar in terms of seed yield. In the second year of the experiment, the lowest seed yield in Kirazli variety was recorded in RL + AA application, while the lowest value was 45.4 kg/da in AA application (Table 3). According to the results of the combined analysis, Kirazli variety showed a positive increase in seed yield in response to the RL application and a significant increase compared to the control parcels.

In general, bacterial applications showed a markedly reducing effect on the Urunlu variety. Kirazli varieties in terms of varieties in terms of seed yield was more efficient than the Urunlu variety. The seed yield in the leaf-reduced varieties is the main selection criterion (Snoad, 1974; Heath and Hebblethwaite, 1985). In this study, the genetic structure of this type has been effective in producing more seeds of semi-leaf Kirazli variety. Indeed, Acikgoz and Uzun (1997); Long (2001) researchers have obtained similar results.

Temperature and hail precipitation values recorded in the second year of the experiment caused a significant decrease in seed yield. Because the high temperatures in pea pea in the cool season plant cause a serious decrease in seed yield (Ney et al. 1994). In the trial there was no significant difference in seed fertilizer application in terms of seed yield. This result was effective in the area of the test area soils phosphorus. Combined analysis of the seed yield in the yield of the year x varieties of varieties in the generative period of high temperature and drought caused by the more affected than kirazli varieties. The yield of the rainfall during the year and the temperature in the growing period (Smith and Goeging, 1999) and the effects of the genotypes together yield. The higher temperatures compared to the previous year, especially in the late July and August, the sudden rise of air temperatures and also the heavy precipitation in the period of full grain formation was effective in low seed yield (Figure 1).

Although the response to bacterial applications in the combined analysis was different, RL administration with its general lines showed an effect of increasing the seed yield (Table 3). Some researchers have also stated that *Rhizobium* significantly affects grain yield (Sharma et al. 1989; Vadavia et al. 1991; Khan et al. 1992).In *Arthrobacter agilis* applications, negative reaction has emerged. Sufficient phosphorus content of soils can be effective in this bacterium. However, the reaction in the first year in the Urunlu type is negligible. Therefore, it can be stated that *Rhizobium* vaccination is necessary in Erzurum and similar ecologies especially in seed pea cultivation. Phosphorus solvent bacteria appears to be useful under favorable conditions. This effect can be more pronounced especially in cooler years.

1000 Seeds Weight

In the first year of the experiment, the average weight of a thousand seeds was 200.7 g. In the application of phosphorus between 197.0 and 205.0 g. In bacteria applications between 196.5 and 210.3 g. In the second year of the experiment, the average weight of 1000 seeds was 180.7 g. In this year, the seeds of the seeds of Kirazli was 175.6 g and the weight of the seeds of the Urunlu varieties was 185.8 g. This difference between the thousand-weight of varieties was not significant. One thousand seeds weight is an indication of the seed size of the plant. The seeds of the two pea varieties (Kirazli ve Urunlu) were found to be similar in this study. There are similarities in terms of seed size, which are already recorded by the breeding institution (Anonymous, 2004). In the combined analysis of years, this difference in the weight of thousands of thousand weights ranging from 188.1 to 95.4 g as a result of phosphorus fertilizer applications did not show statistical significance. The difference between the weight of thousands of grain in the second year in the second year during the filling period of hot and dry weather was effective. Since the drought is shortened by the grain filling period, the decrease in the amount of assimilate to be reduced to the grain is expected to be a result (Kacar, 1996; Kocacaliskan, 2004). As a matter of fact, this situation was effective in the decrease of one thousand seeds weight in the second year. The fact that the phosphorus content of the soils is not sufficient to record the reaction of phosphorus fertilizer in terms of thousand weight has been effective. The values recorded in terms of one thousand grain weight were similar to the studies on this subject (Uzun and Acikgoz, 1998; Anlarsal et al. 2001; Uzun et al. 2005).

Crude Protein Ratio in Seeds

In the first year of the experiment, there was no significant difference between the varieties of the crude protein ratio of 29.0%.The seeds of Kirazli have 29.1% crude protein and 29.2% crude protein. In the first year, the rate of crude protein in the seed, which is 29.1% against phosphorous fertilizer applications and does not change according to the doses, has changed between 28.4% and 29.6% depending on the bacterial applications. Bacterial applications showed an effect of increasing the rate of seed crude protein in Kirazli type, while decreasing effect on the Urunlu type.

In the second year of the experiment, the seeds of Kirazli were 32.7% and the seeds of the Urunlu were 33.5% of crude protein. In the second year, the application of phosphorous fertilizer showed a decreasing effect on the ratio of grain crude protein. The rate of seed crude protein in bacterial applications ranged from 32.8 to 33.4%.The resulting change was not statistically effective. As the second year of the experiment has been drilled, less asimylate has been transported to the grain since it shortens the filling period. As a result, the proportion of crude protein is proportionally increased as carbohydrate decreases proportionally. As a matter of fact, the rate of crude protein in the grain due to drought increased in Ozturk and Caglar (1999) and Mut et al. (2007) by wheat, Dwivedi et al. (1996) by peanuts.

In the combined analysis, the effect of phosphorus fertilizer application on the grain protein ratio was not recorded. The rate of grain crude protein, which was 31.2% on average, ranged from 30.8% to 31.6%, depending on the applications. Although phosphorus application causes an increase in the grain protein content in legumes (Erman et al. 2009), the phosphorus level of the test area soils has prevented this result. The ratio of the crude protein ratio in the bacterial applications ranged from 30.8% to 31.6%, which was 31.2%, and therefore the bacterial applications did not affect the protein content of the peas.

In this study, a significant increase in crude protein ratio was observed in RL and Kirazli varieties seeds. The decrease in Urunlu is probably due to the effect of bacteria on plant physiology. In many studies, the effect of the bacteria on the year and the environment and changed to according to the variety of plants (Şahin et al. 2004; Lucy et al. 2004; Khalid et al. 2004; Çakmakçı et al. 2006). As a result, the Kirazli variety, which can produce satisfactory seeds in the region, has around 30% grain protein content. With this aspect can be a good alternative protein source for the concentrated feed industry. Inoculation of the plant with RL yields positive results both in terms of seed yield and crude protein content.

Conclusion and Suggestions

As a result of today's modern agricultural practices, intense, inaccurate and excessive chemical fertilizers and pesticides are used. In particular, chemical fertilizers are washed to reach fresh water sources and cause environmental pollution. This situation negatively affects people and the environment in which they live. Prevention of environmental pollution, agricultural sustainability and natural resources need to be protected. Therefore, the use of chemical inputs should be reduced or the applications should be expanded by using environmentally friendly techniques and necessary research should be carried out.

When the results are evaluated as a whole, it can be stated that Kirazlı variety is more suitable for seed production in the region. Because the yield differences were not much compared to years and seed yield was significantly higher than the Urunlu variety. With this aspect, it is a good alternative for seed feed production. When the reaction areas of phosphorous fertilizers were not sufficient, the phosphorus content of the soil was effective. Before sowing in the area to be planted in the pea, soil analysis should be done to determine whether or not to give phosphorus fertilizer. If the test area is poor in terms of phosphorus, phosphorus should be added.

It is not correct to make a clear judgment on the results of this experiment on phosphorus-soluble bacteria. Some characteristics showed a good response for one year, the next year the opposite situation has arisen. This is due to the change of bacteria response to changing environmental conditions. Based on these results, it can be said that it would be beneficial to develop bacterial strains that will have a positive effect on the wider environmental range and to try to obtain a more healthy result in poor soil in terms of phosphorus. Rhizobium inoculation has responded positively to the trial. This response is more pronounced in the insufficient soils of Rhizobium. Based on soil analysis, it would be more appropriate to decide on inoculation.

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Profitability and Efficiency of Production Inputs on Rice Farming at Karanganyar, Central Java-Indonesia

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Abstract

Increasing rice productivity and quality is sustainable efforts carried out continually. Socio-economic farmer's characteristics, profits and efficiency study in using production inputs on rice farming was successfully carried out using survey method from 30 farmers with structured questionnaire sampled randomly in Jetis sub-district, Karanganyar district, Central Java. Data analysis was done using descriptive statistics, profit analysis and production function. The results showed that rice farming at Karanganyar district, uniquely, was supported by productive age of farmers with more than 20 years' experiences and 86.7% of family labor. Revenue cost ratio (RCR) of the rice farming was high up to 2.26 mainly influenced by farm size, urea fertilizer and labor. Though the rice farming had high RCR, the farming was still backed up by not efficient yet and inefficient status of production inputs, except labor. Collaboration of farmers, local-national government and utilization of technologies is recommended to improve the rice farming.

Key words: Cost efficiency, production inputs, profit, and rice.

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INTRODUCTION

Rice (*Oryza sativa* L.) is the most important, strategic and politic food commodity in Indonesia due to more than 250 million people of the country depending on the commodity (Romadhon, 2017). Based on Agriculture Department data, it was known that total rice cultivation areas are 4.8 million ha with production of milled dry grain reaching 81.3 million tonnes and production surplus up to 17.4 million tonnes in grain and 2.85 in rice (Kontan.co.id, 2018). The rice price in wholesaler level during 2018 was 12,106 rupiahs per kg and increased 2.26% compared to 2017. Though Indonesian rice self-sufficiency has been established from 2016 till now and high economical values performed, increasing rice production, productivity and quality are generally carried out continually, not only in national level, but also in local scope.

Central Java is one of the main food producers and national food stock buffers in Indonesia, both food and horticulture crops (Statistics of Jawa Tengah Province, 2018). In rice, Central Java is the most important province with 1.8 million ha total rice cultivation areas, 9.51 tonnes per ha and 6.10 tonnes per ha their productivity (Movanita, 2018). In Central Java province, the highest productivity up to 7.53 tonnes per ha noted at Sukoharjo district and the lowest productivity of 4.31 tonnes per ha recorded at Pekalongan district (Statistics of Jawa Tengah Province, 2018). Furthermore, Karanganyar district is one of rice cultivation centers in Central Java with total cultivation areas of 48.131 ha, 311.919 tonnes total of production and 6.48 tonnes per ha their productivity in 2018 (Statistics of Karanganyar, 2018). Though the productivity was still lower than potential productivity of rice that can reach 8.42 to 10.58 tonnes per ha (InvestorDaily, 2019)) and Sukoharjo district, but the value was higher than that of Central Java productivity average value of 6.10 tonnes per ha (Statistics of Jawa Tengah Province, 2018; Statistics of Karanganyar, 2018a). The higher production of the rice both quantity and productivity was mainly reached successfully by optimal rice farming management with production input efficiency.

Production input efficiency is an effort to use resources efficiently in finding the highest production output in the final process. In optimal rice farming that can increase high profitability and production output, the production input efficiency is an important strategy significantly addressed for the purposes. Resource use efficiency on land, labor, fertilizer, herbicides, tools, seeds and equipment that affected to rice output was successfully conducted at Kwande local government area of Benue State-Negeria (Akighir and Shabu, 2011). Efficiency of resource use on labour, seed, fertilizer, plant protection chemical, capital and land for rice production was determined in Manipur-India (Devi and Singh, 2014). Production cost efficiency on labour, herbicides, fertilizer, seed and transportation gave high effect on *Abakaliki* rice production in Ihialia Local Government Area of Anambra State, Nigeria (Egbodion and Ahmadu, 2015). Irrigation, production techniques and amount of agricultural supporting staff were the most important influencing factors of rice production’s technical efficiency in Cambodia (Kea et al., 2016). Lack of education, quality seeds, and irrigation machinery exhibited high effect on rice production efficiency at Bihar-India (Ahmad et al., 2017). The production input efficiency studies via paying attention on farm size, seeds, fertilizer, irrigation, labor, control of pests and diseases, government assistance, education, age of farmer, farming experiences, etc were also successfully conducted at Subang and Kerawang district, West Java (Tinaprila et al., 2013);

Tabanan, Buleleng and Gianyar districts, Bali (Suharyanto et al., 2015), North Pamona district, Central Sulawesi (Momondol and Tambe'o, 2016); Jember district-East Java (Wardana et al., 2018).

Though those studies were successfully conducted at several districts and provinces, there is no production input efficiency and profitability study on rice farming at Karanganyar distict, Central Java.

Objective of the study was to analyze production-input efficiency and profitability on rice farming at Karanganyar district, Central Java. The specific objectives were to examine the socio-economic characteristics of Karanganyar rice farmers in study area, to determine production input efficiency and profitability of rice farming at Karanganyar, Central Java.

MATERIAL AND METHODS

Jaten is one of 17 sub-districts of Karanganyar district. The sub-district is located 5 km from Karanganyar City to the west. Total area of the sub-district is 25.55 km^2 with 110 m above sea level (asl), total population is 84,145 persons consisting of 41,425 males and 42,721 females (Statistics of Karanganyar, 2018b). The Jaten has boundaries with Kebakramat sub-district in the north, Sukoharjo district in the south, Surakarta City in the west and Tasikmadu and Karanganyar sub-districts in the east. The several areas of the sub-district are the favoured agricultural area and has tropical climate with the rainy season between September to February and a dry season from March to August. This study was carried out from August to October 2017. The reason in selecting of August to carry out the study was based on reality that in this month, farmers finished their rice harvesting and marketing, so the farmers had enough time for interview both individually and in group.

A random sampling technique was employed to select a total of 30 farmers from the area. Data were collected by means of a structured questionnaire administered to the respondents, complemented with personal interview. The data collected covered (1) the socio-economic characteristics of respondents, 2) quantity and prices of production inputs, and 3) quantity and price of rice.

The rice farmers in Karanganyar district used production inputs in the form of seed, Urea, ZA and Phonska fertilizers, manure and labor. The number of input used was based on the farmer's habits and their capital. To know the profit of rice farming, the data obtained were analyzed financially using formula as described by Girei and Onuk (2016). The profitability of rice farming model is expressed as follows:

$\pi = TR - TC$ and $B/C = \pi/TC$

where :

π = profitability of rice farming (IDR/ha)

TR= total revenue (IDR/ha)

TC = total cost (IDR/ha)

R/C = feasibility of rice farming system

If the $R/C > 1$ means that the farmers have benefits so that rice farming is feasible to be developed, if $R/C < 1$ means that the farmers did not get a profit or loss so the rice farming is not feasible to be developed, but if $R/C = 1$ means farmers do not get profits but also do not gain lose, in this condition farmers are at break-even point.

To explore effect of all factors in the production process, the all factors were analyzed using the production function as described by Kea et al. (2016) as follows:

$$\text{Ln } Y = \ln a + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 + \alpha_3 \ln X_3 + \alpha_4 \ln X_4 + \alpha_5 \ln X_5 + \alpha_6 \ln X_6 + \alpha_7 \ln X_7 + \mu$$

where:

Y	= production of rice (kg)
X_1	= area planting (ha)
X_2	= quantity of seed (kg)
X_3	= quantity of Urea (ha)
X_4	= quantity of ZA (kg)
X_5	= quantity of Phonska (kg)
X_6	= quantity of manure (kg)
X_7	= quantity of labor (man/day)
α	= regression coefficient
μ	= galat error

To know the accuracy of the production inputs, further analysis was carried out using value marginal product ($VMPx_i$) dan price of production inputs (Px_i). Production inputs used during rice farming were efficient when $VMPx = Px_i$ or ratio marginal product value and price inputs equal with 1 (Akighir and Shabu, 2016). Mathematically the formula is as follows :

$$VMPx_i = Px_i \text{ atau } VMPx_i/Px_i = 1 = k_i$$

Use of production input is not efficient yet because : 1) its use still low and 2) its use too high (Budiono and Adinurani, 2017) :

1. $k_i > 1$, means that the use of the production inputs, x is not efficient yet, to achieve the efficient production input, x shall be increased
2. $k_i < 1$, means that the use of the production inputs, x is not efficient yet, to achieve efficient production input, x has to be reduced
3. $k_i = 1$, means that the use of production input, x is efficient.

RESULTS AND DISCUSSION

Based on the socio-economic characteristics of respondents, it shows that 50.0 % of farmers were 15 - 60 years old and more than 60 years old (Table 1). The lowest age was 40 years and 77 years was the oldest age of respondent. This result shows that most of farmer was in productive age. The high productive age generally let to high rice farming occurred. The productive age was significantly strengthened by farming experience more than 20 years up to 63.3% and 86.7% of family work on farming activities. The strong points could cover weak characteristic dealing with education level that was only in elementary school.

Table 1. The Socio-economic characteristics of respondents

No	Description	Number	%
1.	Age of the family head		
	a. < 15 years	-	0.0
	b. 15 – 60 years	15	50.0
	c. > 60 years	15	50.0
2.	Education level:		
	a. Not school	3	10.0
	b. Elementary school	17	56.7
	c. Junior high school	5	16.7
	d. Senior high school	4	13.3
	e. Bachelor degree	1	3.3
3.	Farming experience		
	a. < 10 years	1	3.3
	b. 10 – 20 years	10	33.3
	c. > 20 years	19	63.3
4.	Number of family		
	a. ≤ 2 person	7	23.3
	b. 2 – 4 person	20	66.7
	c. > 4	3	10.0
5.	Work of family head		
	a. On farm	26	86.7
	b. Non farm	4	13.3

Performances of production inputs studied in Karanganyar district were expressed on farm size, seed, urea, phonska, and ZA fertilizers, manure and labor (Table 2). From the statistic summaries, it was clearly known that Karanganyar rice farmers were categorized in small scale farmers with farm size from 0.17 to 1.50 ha and 0.58 ha in average. For the small scale farmers, optimal using of all production inputs was generally carried out to gain maximal results. Seeds used by the farmers were Inpari 33 variety in 29.7 till 50.0 kg/ha with 32.5 kg in average. Inorganic fertilizers of urea, phonska and ZA were used on 175.0, 250.0 and 100.0 kg/ha in average respectively. Manures derived from organic materials such as goat, sheep, cow and chicken or plant wastes easily found around farmer environment and cheaper were usually applied 200-350 kg/ha with 262.5 kg/ha in average.

Table 2. The average use of production inputs per hectare on rice farming at Karanganyar district, Central Java

No	Type of Input	Minimum Value	Maximum Value	Average
1.	Farm size (ha)	0.17	1.50	0.58
1.	Seed (kg)	29.70	50.00	32.50
2.	Urea fertilizer (kg)	150.00	200.00	175.00
3.	Phonska fertilizer (kg)	150.00	300.00	250.00
4.	ZA fertilizer (kg)	75.00	150.00	100.00
4.	Manure (kg)	200.00	350.00	262.50
5.	Labor (man/day)	78.00	106.00	93.50

Labor at rice farming in Indonesia, involving at Karanganyar generally comes from within the family and some from outside the family (hired). Labors from family were usually employed for maintaining activities, i.e. fertilizing, weeding, and controlling pest and disease; while hired labors were worked by farmers on land processing, planting and harvesting activities. The labors employed in one planting season were as high as 93.50 man/day with a range of 78 – 106 man/day/ha.

Cost of rice farming is an expenditure of farmers to buy production inputs and pay labor wages. The rice farming activities get a profit when the rice yields derived from the activities can cover all farmer's expenditures and still leave other results to support their daily life. The cost structure of rice farming showed that wage of labor had the largest proportion up to 68.32% from total cost. The wage cost of labor used by farmers to pay nursery, land processing, planting, replacing dead plants, fertilizing, weeding, controlling pest and disease, and harvesting activities. Land processing using tillage machine, planting and harvesting were generally carried out by wholesale model, while weeding, fertilizing and controlling pest and disease were conducted as daily works. Furthermore, second high proportion cost was noted on tractor used during land processing with 11.69% and other production costs were less than 6%.

Rice production yield average obtained by farmers after harvesting time was 5 514.50 kg/ha (Table 3). At price level of IDR 4,200/kg, farmers got the revenue up to IDR 23,160,900/ha. The total production cost for rice farming activities was IDR 10,263,750. By reducing revenue with total production cost, in the end of process farmers gained the profit of IDR 12 897 150/ha. By dividing revenue with total cost of production, it was proved that RCR of rice farming in Karanganyar district was as high as 2.26. The RCR more than 1 gave indication that rice farming in the district was feasible economically to be developed. This is mean that every expenditure cost of IDR 1,000 for the production inputs, farmers got revenue of IDR 2,260.

Table 3. The average of cost and revenue on rice farming at Karanganyar district, Central Java

No	Type of Input	Average	Percentage of total cost (%)
1.	Cost of rice farming :		
	1. Seed (kg)	390,000	3.80
	2. Urea fertilizer (kg)	350,000	3.41
	3. Phonska fertilizer (kg)	600,000	5.85
	4. ZA fertilizer (kg)	180,000	1.75
	5. Pesticides	400,000	3.90
	6. Manure (kg)	131,250	1.28
	7. Labor (man/day)	7,012,500	68.32
	8. Tractor	1,200,000	11.69
	Total	10,263,750	100.00
2.	Production :		
	1. Production quantity (kg/ha)	5,514.50	
	2. Price (Rp/kg)	4.200	
3.	Revenue (Rp)	23,160,900	
4.	Profit	12,897,150	
5.	Revenue Cost Ratio (RCR)	2.26	

The results of the regression analysis of all factors indicated that most of production inputs gave significant effect on rice production at Karanganyar district. The coefficient of determination (R^2) obtained was very high up to 0.9427, meaning that 94.27% of rice production was influenced by variables studied, especially farm size and urea fertilizer, followed by labor (Table 4), while 5.73% was affected by other factors outside of the model such as rainfall, humidity, air temperature, etc. The results were also strengthened by F-test value of 51.72 that was greater than the F-table (3,47). Very significant effect (99%) of rice production was affected by farm size and urea fertilizer with 0.748 and 0.306 regression coefficients, respectively.

Significant effect (95%) of the production was showed positively by labor with 0.290 the regression coefficients and negatively by ZA fertilizer with – 0.021 the coefficients. For the positive effect of variables, increasing of them up to 10% will raise rice production up to 7.48; 3.06 and 2.90% for farm size, urea fertilizer and labor, respectively. However, for negative effect of ZA fertilizer, rising the variable up to 10% will reduce the production of rice down to 0.21%. The variance inflation (VIF) value obtained was less than 10, indicating that the model used was free from multi-collinearity problems.

Table 4. The estimation of factors that influence rice production in Karanganyar district, Central Java

Independent Variabel	Co-efficient.	St. Error	t-test	Probability	VIF
1. Constanta	5.835^{***}	1.048	5.57	<.0001	0
2. Farm size	0.748^{***}	0.201	3.72	0.0012	0.232
3. Seed	0.317	0.226	1.40	0.1749	7.403
4. Urea fertilizer	0.306^{***}	0.148	2.07	0.0506	6.368
5. ZA fertilizer	-0.021^{**}	0.011	1.86	0.0768	1.955
6. Phonska fertilizer	-0.273	0.209	1.31	0.2046	0.563
7. Manure	0.073	0.083	0.88	0.3868	3.931
8. Labor	0.290^{**}	0.155	1.86	0.0758	4.089
R^2	0.9427				
F-test	51.72				

Production input efficiency as an effort to use resources efficiently in finding the highest production output can be captured from farmer habit, experience and capital. Results of the study indicated that though the RCR of rice farming at Karanganyar reaching 2.26, production inputs on the Karanganyar rice farming activities were still managed and used in-efficient situation in most of variables, except in labor variable. The RCR was primarily affected by farm size variable. This results, in fact, had closely relation to socio-economic characteristics, where rice farmers at Karanganyar generally had low education level (Table 1) and rice farming was usually carried out based on their parent habits without involving innovation technologies. This situation let to not efficient yet for seed, urea fertilizer and manure and in-efficient status for ZA and phonska fertilizer occurred naturally (Table 5). While labor was the one of the production inputs with efficient status. The efficient status was occurred due to most of Karanganyar farmers dominantly used labor within family to reduce hired labor cost.

Table 5. Estimation of Production Inputs Efficiency of rice farming in Karanganyar district, Central Java

Type of Production Input	Marginal Product	k_i	t_{hitung}	Status
1. Seed	53.788	18.826	1.328	Not efficient yet
2. Urea fertilizer	9.642	20.249	1.965	Not efficient yet
3. ZA fertilizer	-1.158	-2.702^{***}	-2.616	Inefficient
4. Phonska fertilizer	-6.022	-10.538	-1.430	Inefficient
5. Manure	1.534	12.882	0.811	Not efficient yet
6. Labor	17.104	0.958	-0.082	Efficient

Entirely from the study, it was successfully revealed evidents on the rice farming at Karanganyar, Central Java-Indonesia. The Karanganyar rice farming was dominantly supported by farmers who had wide range of age from 15 – 70 years olds, low education level of elementary school and more than 20 years experience on rice farming downgraded from their parents and 90% work on farming activities.

Almost similar results on socio-economic farmer characteristics were also reported on Minahasa-North Sulawesi (Wangke, 2012), Kantong Perantau-West Sumatra (Afrizal et al., 2017). In several areas such as Bagan Terap, Panchang Bedena, Pasir Panjang, Sawah Simpadan, Sekinchan, Sg Leman, Sg Nipah, and Sg Burong of Malaysia, farming of rice was significantly backed with male farmers, married, 18.2% with 40-44 years old, 47.5% primary education, and 88.4% work on farming activities (Alam et al., 2010). In Kano State of Nigeria, rice farming was mainly fullfiled by male farmers, married, 44% with 41-50 years old, small farm size of 0.5-1.0 , 68% inherited, 80% Quranic education (Maji et al., 2012). Almost similar results with difference in 88% primary education were resported at Ogun State of Nigeria (Afolami et al., 2012) and Ekiti State of Nigeria (Osanyinlusi and Adenegan, 2016). Male farmers with 52.6%, married of 93.9%, and 60% illiterate were recorded on rice production in Ethiopia (Tsega et al., 2013), 30-50 years old of farmer age up to 66.1%, 41.9% SSC to intermediate education level, 11-20 year experiences were charateristic performances in Telangana, Coastal Andhra and Rayalaseema regions of Andhra Pradesh-India (Samarphita et al., 2016). From these results, there were almost similar socio-economic characteristics between Karanganyar farmers with Nigeria farmers generally.

The average use of production inputs per hectare on Kranganyar rice farming indicated different performances of 0.58 ha farm size needing 32.5 kg seed, 175 kg urea, 250 kg phonska, 100 kg ZA, 262.5 kg manure and 93.5 man/day. In Sumatra-Indonesia, to produce 2514 kg in 5897 square meters used 27 kg seed, 176 kg fertilizer, and 48 man/day labor (Haryanto et al., 2016). In Haryana state of India, for 2.57 ha land size of rice production and 108 quintals output, it was needed 1217.1 man/day, 441.8 kg NPK, 7854.5 Rs irrigation expenditure, and 2111.1 Rs insecticides (Goyal et al., 2006). In Muara and Temburong district of Brunei, to produce 1.74 tons of rice yield used 182 kg fertilizer, 12.3 ml herbicide, 2.6 ml pesticide and 1.68 man (Galawat and Yabe, 2012), 478.7 kg of rice yield from 0.6 ha farm size in Kwara state, Nigeria demanded 37.8 man/day, 7.34 kg seed, 10.5 kg fertilizer, and 9.9 liters' herbicide (Ogunniyi et al., 2015). These studies figured out that every rice production had different and specific needs to produce optimal rice yield.

Cost and profitability analysis of rice farming in Karanganyar District was high up to 2.26 of RCR, though the rice farming was only supported by male farmers having low education level and more than 20 year experiences. In the previous study in the similar area, the RCR of rice farming was 2.02 (Barokah et al., 2014), 2.88 RCR was reported in Aceh Besar district-Aceh (Fitria and Ali, 2014), 1.97 RCR was noted on organic rice farming at Tasikmalaya district-West Java (Wihastuti et al., 2017), 2.51 RCR of non upsus rice at Batang Asam district-Jambi province (Saidin and Adlaida, 2017), 1.6 benefit cost ratio (BCR) at Tapin district-South Kalimantan (Susmawati, 2018). In other countries, it was reported that BCR of organic rice production in Chitwan-Nepal was 1.15 (Adhikari, 2011), 1.39 – 3.24 BCR were recorded on Mardanai, Sara Saila, Basmati and Fakhre Malakand varieties at Malakand and Lower Dir district, Pakistan (Ahmad et al., 2015). Though each area had different RCR and BCR, it is fact that generally rice farming activities gave positive effects on farmer incomes.

In every area of rice production, successful in rice farming was affected by several factors. At Karanganyar rice-farming, 94.3% of rice production was significantly influenced by farm size, urea fertilizer and labor. Almost similar results on rice production in Sengah Temila sub-district of Landak district was significantly influenced by land size, seeds, pesticides and labors (Pudaka et al., 2018). At Benue State of Nigeria, farm size and fertilizer significantly affect the output of rice (Akighir and Shabu, 2011).

Soil fertility status, access to credit, household size and farmers experience were the factors that influence the efficiency levels of smallholder rice farmers at Southern Malawi (Magreta et al., 2013). Fertilizers, pesticides, labors, experiences, and distance to market were critical variables on rice production at Mekong Delta, Vietnam (Duy, 2015)). Age, education, experience and farm size significantly influence the farmers' efficiency in rice production at Kwara State-Nigeria (Ogunniyi et al., 2015). Abakalake rice production per hectare at Anambra State, Nigeria was obviously influenced by labour, herbicides, fertilizer, seeds and transportation (Egbodion and Ahmadu, 2015). Farm mechanical tools was determinants factor in rice production in Myanmar (Tun and Kang, 2015). Land, fertilizer and pesticide were major factors influencing household's rice production ant Battambang district-Cambodia (Kea et al., 2016). Rice farming efficiency at Bihar-India was affected by seed and household head (Ahmad et al., 2017). Distance to fields, mechanization, agricultural assets, share of remittances, education of household heads, and distance to town were important factors on rice production at Thailand (Ebers et al., 2017). Urea, MP, labor, irrigation and seed were high significant factors on production at Satkhira district in Bangladesh (Islam et al., 2017). Those results indicated that each rice farming area had specific and important factors differently.

Though RCR of rice farming at Karanganyar-Central Java was high, from six variables studied, only labor was in efficient status. While the most of variables was in not efficient yet and inefficient status. Therefore, improvement of those variables were importantly addressed via different approaches such as application of integrated crop management and innovation technologies related to rice cultivation. To support this condition, important role of local and national government is needed to accompany farmers in improving production input management and utilization. In other studies, high efficiency variables on rice production at Lamongan District-East Java-Indonesia were noted on land, urea, fertilizer and herbicide (Budono and Adinurani, 2016), at Mahiyanganaya-Srilangka on farmer experience (Shantha et al., 2013), at Myanmar on labor and mechanical tools (Tun and Kang, 2015), at Jare Bowl Borno State of Nigeria on irrigation water (Wakil et al., 2018). These results gave challenge and chance to keep and maintain efficient production input applied as is as and to optimize and improve inefficient or not efficient yet status to efficient status. The optimization and improvement the status expected can lead to enhancing farmer profits and production input efficiency on rice farming.

CONCLUSIONS

Rice farming at Karanganyar district, uniquely, was supported by productive age with more than 20 years experiences and 86.7% using family labor. The RCR of the rice farming was high up to 2.26 that was mainly influenced by farm size, urea fertilizer and labor. Though the rice farming had high RCR, most of production inputs was still in not efficient yet and inefficient status, except labor. Therefore, to optimize the rice farming at Karanganyar district it was recommended to improve application and utilization of seed, urea, ZA, phonska fertilizer and manure. For those problems, significant role of local and national government and application of innovation technologies on cultivation and agronomical aspects are significantly addressed. Successful improvement of the rice farming at Karanganyar district is depended and affected on mutual and simultaneous collaboration and cooperation between farmers, local-national government and utilization of suitable innovation technologies for the area.

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CONFLICT OF INTEREST

We stated that there is no conflict interest between all authors and research funding institute in accordance with the publication

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Determining The Detoxification Potential of Some Soil Bacteria and Plants on Bioremediation of Deltamethrin, Fenvalerate and Permethrin Pesticides

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Abstract

The aim of the study was upgrade the phytoremediation method for cleaning receiving environmet exposed to three kind of pesticides (Deltamethrin, Fenvalerate and Permethrin) for application of selected specific soil bacteria and agricultural plants. Efficient biodegradation of herbicides by bacteria depends of effectively uptake by the crops and expose aerobic biodegradation via detoxification enzymes of plants. These treatment techniques can take up degradation of toxic compounds into nontoxic compounds. The results of this study using *Microbacterium chocolatum, Ochrobactrum thiophenivorans, Sphingomonas melonis, Sphingomonas aquatilis* and *Bacillus subtilis* and crop phytoremediators in the experimental studies are presented. As a result of the experiments, It is understood that the using of recent techniques come close to decrease effects of pesticide pollution in artificially polluted agricultural lands.

Keywords: Phytoremediation, pesticide, biodegradation, enzyme

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INTRODUCTION

The contamination of the environment by herbicides is a major problem (Mohamed et al., 2016). The enzymes that has a role in biotransformation are related with metabolizing enzymes. On the chemical structure of foreign compounds, their metabolic activities may also be used to identify the role of a livings, via their enzymes (Hodgson, 2010). Although Bioremediation methods of treatment of persistent organic pollutants are economically, effective, ecologically and also profitable for bioremediation of receiving evnvironments, in addition, organochlorine herbicides have low productiveness as only a few strains of bacteria are adaptable to show the effective mineralization of these pesticides as a result of oxidative and non oxidative transitions (Khalid et al., 2017). Dehalogenation is principal mechanism for methydetoxification of various organochlorine pesticides, making them vulnerable to attack by other biodegradative (Shehu et al., 2019). Plants and biodegraders used for phytoremediation acticities may be suitable in case of pollution with organochlorine pesticides (Kurashvili et al., 2014).

Bioremediation of herbicides that comprises the potential of bacteria/fungi in the treatment of persistent organic compouns is related with low cost process. This process comprises the organic compound into inorganic compound. For the reason of properties of microorganisms, their biomass comparative to other organisms in the receiving environmet, and catalytic capabilities in their process (Paul et al., 2005), and their properties to purpose even in the deficiency of oxygen for chemical materials bioremediating bacteria, understanding their biochemistry, and also recent methods for their practical in the receiving environments have evolved in recent years Megharaj et al., 2011).

While herbicides exists in receiving environment, there is likely difference in biodegradation capabilities and microbial populations of receiving environments are composed of microbial communities instead of a single strain (Ramakrishnan et al., 2011)..

In habitat, biodegradation/bioremediation includes products within a well-coordinated bacterial community and transferring the substrates (Abraham et al., 2011). Most of the bacteria have the interaction properties, both physically and chemically, with substances preeminent to conclude biodegradation of target pollutants. Most of the microorganisms are pesticide degraders (Briceño et al., 2007).

When the biotransformed persistent organic pollutants are released into the soil or aquatic system, it is affected by by microorganisms (Diez, 2010). Microorganisms are known as the extracellular enzyme-producers. These properties are related with the production of enzymes that has an important role on persistents organic compounds. Most of the enzymes are taken in lignin degradation, such as oxidases, manganese peroxidase, lignin peroxidase and laccase. Various bacteria that biodegrade persistent organic pollutants have been isolated and the number of them is increasing day by day. These enzyme types involved in biodegradation are, glutathione S-transferases (GSTs), cytochrome P450 and esterases (Diez, 2010). These enzymes are very important for the biological properties of many herbicides (Riya et al., 2012). Certainly, many researches have proved that some pesticides are more toxic than other types which are first activated in vivo during metabolization by cytochrome P450 monooxygenas (Jokanović, 2001; Rinnofner et al., 2019). Enzymatic degradation of persistent organic pollutants is an advance remediation method for treatment of them from receiving habitat.

Enzymatic biodegradation of persistent organic pollutants can be more useful than other complex methods. Most of persistent organic pollutants are activated in situ by the enzymes, and many herbicides activates by aiming enzymes with substantive physiological functions. (Scott et al., 2008; Rinnofner et al., 2019). Previous studies have shown that the enzyme can be produced at a large scale after immobilization into polyurethanes which may be considered in particular for incorporation into filtration devices (Guendouze et al., 2017).

The biodegradation includes enxymes converging on particular intermediates form a funnel topology, the novel response prevails in the exterior part of the network, and finally, the suştable pathway betweenpesticides and the centre of the metabolism can be arrived in view of all the required enzymes in a given organism (Trigo and Valencia, 2009). For biodegradation of herbicides, three enzyme systems are most useful. These are; esterases, hydrolases, the mixed function oxidases and glutathione S-transferases (Li et al., 2007).

Biodegradation methods is related with the metabolic potential of bacteria/fungi to detoxify the herbicides, which is dependent on bioavailability (Ramakrishnan et al., 2011). In the metabolism of pesticide step, the properties of herbicides are transformed via oxidation process and turned to generally produce a less toxic product than the original form. Other step includes conjugation of a herbicide to an amino acid, which reduces the toxic effets according to the original form. The last step comprises changeover of second step metabolites into secondary non-toxic conjugates. In these steps, microorganisms are changeover producing extra cellular enzymes (Ortiz-Hernández et al., 2013; Van Eerd et al., 2003).

The main purpose of our study is the understanding bioremediation and phytoremediation potential of targeted three kind of pesticides for remediate polluted receiving environment, with application of plants and microorganisms.

MATERIAL AND METHOD

Pesticides, plants and agricultural soil used in the study

Pollutants investigated in this study were Deltamethrin (IUPAC NAME: (S)-cyano-(3-phenoxyphenyl)methyl](1R,3R)-3-(2,2-dibromoethenyl)-2,2-dimethylcyclopropane-1-carboxylate), Fenvalerate (IUPAC NAME: cyano-(3-phenoxyphenyl)methyl] 2-(4-chlorophenyl)-3-methylbutanoate and Permethrin (IUPAC NAME: [(3-phenoxyphenyl)methyl 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropane-1-carboxylate). Maize, Alfalfa and soybean used for testing.

Crops after application on pesticides (0.01, 0.1 or 1 mM) with five days were cleaned with pure water, sprouds and roots seperated in 0.05 M phosphate solution at pH 7.4. Seperates were tightened through muslin cloth and they centrifuged at 1000 g for 30 minute for acquire the supernatant activities of enzymes. The artificial land has been polluted with Deltamethrin, Fenvalerate and Permethrin for model study step. The soil type used in the study was fertile, alkaline and humid. Maximum soil particle was about 2 mm. The experimental studies have been continued in 250 ml of Erlenmayer flasks. Each air dried sample equals approximately 100 g. About 100 ppm of pesticide applied in soil samples for pollution. At the starting phase of experimental studies, the suspension of microorganism inoculated in the studied polluted agricultural soil about 20%. The samples have put in the thermostat at room temperature over five days. The grains of crops planted in divided samples of agricultural soil (20 grains for maize, soybean and alfalfa in every sample). Experimental studies contains two type of control with and without water.

Isolation and identification of bacteria

In bacteria isolation process, agricultural soil samples taken from agricultural fields of Mediterranean, East Anatolian and Marmara region of Turkey transfered in sterile glass containers (Zelles et al., 1991). 10 g of agricultural soil was diluted to 10^{-4} in 0.8% sodium chlorate isotonic solution. In a laminer flow sterile cabin, 0.1 ml of this sample was inoculated into plate count agar (PCA) which was sterilized in an autoclave before. After this phase, the petri dishes were put in a incubator at 28°C; about five days while the growing phase of the bacteria finished. For identification of bacteria, Phire Hot Start II DNA Polymerase was used. Polymerase Chain Reaction (PCR) bands of various lengths (1000–3000 bp) were gained through 16S ribosomal general primers. 16S rRNA forward primers used were as “AGA GTT TGA TCC TGG CTC AG” while 16S rRNA reverse were as “ACG GCT ACC TTG TTA CGA CTT”

Determination of pesticides

The model experiments carried on with 40 days. The bacteria in The Munzur University Department of Environmental Engineering Collection of Microorganisms Cultures were used for determinig the biodegradation properties on herbicides. The capability of bacteria to degrade organic pesticides was revealed by growing phase on PCA media at 28^0C. For the screening modified PCA media, containing Deltamethrin, Fenvalerate and Permethrin was used. As inoculant, vegetative culture grown up to the exponential phase of growing media used. The PCA media were inoculated with 20% of the microbial suspension.

For determine amount of Deltamethrin, Fenvalerate and Permethrin residues in the soil, 10 g of soil sample were combined with anhydrous sodium sulfate and then these samples were extracted with a proper solvent using EPA 3550C (EPA, 2007) ultrasonic extraction method. For analytical determination of pesticides, the extracted samples were taken into a 250 ml beaker, and surrogate spiking solutions and matrix spiking (1.0 ml of each) solutions were added to the saples. The soil samples were scanned twice for 30 min with 50 ml of the extraction solvent mixture (1:1 Hexane and acetone for GC-ECD analyses pure) in ultrasonic bath. The extract supernatants were filtered through Whatman Grade No. 41 Quantitative Filter Paper, Ashless, Whatman 1441-047/ 28477-974 using a Buchner funnel. For eliminate unwanted interaction of organic matters such as PAHs, PCBs, etc., an alumina-silicic acid column used. These chemicals were heatet at 450^0C in baker for 6 hours and then let cooled down to the room temperature in a desiccator. Separation column was forged by 3 g silicic acid that contents of 3% ultra püre water, 2 g neutral alumina that consist of 6% ultra pure water, and 2 g Na_2SO_4 according to the Ref. given by Jantunen et al., (2000). After this process ended, column was pre-washed with 20 ml of dichloromethane solvent. Sample was evaporated to 2 ml and spilled to the column. At least, dichloromethane was added to resolve the herbicides according to Cindoruk (2011). Aliquot part of the samples were placed into a concentrator tube and evaporated to 1 ml in a warm bath using a gentle stream of clean dry nitrogen, for analyzing procedure. Dichloromethane was used for washing up step. After that, the final extract (approximately 1 ml) was analyzed for the Deltamethrin, Fenvalerate and Permethrin residues using the method described in EPA 8081B (EPA, 2007). Retention time for tested pesticides are: Deltamethrin: 7.1 minute; Fenvalerate; 7.5 minutes and Permethrin; 7.0 minutes. The quantification of all pesticides was carried out using a Perkin Elmer Clarus 500 gas chromatograph wit Electron Capture Detector.

Determining protein content

For determinating the protein content of the samples, Bradford (1974) method was chosen. Phenoloxidase activity was identified spectrophotometrically at 420 nm, according to the pyrocatechol oxidation (Lanzarini et al., 1972), while Peroxidase activity was identified at 470 nm, in comformity with the rate of H_2O_2 addicted oxidation of guaiacol. Activity of monooxygenase was identified polarographically, by oxygen depletion rate at NADP-H addicted oxidation of N, N-dimethylaniline (Khatisashvili et al., 1995), while Glutathione S-transferase activity identified spectrophotometrically at 340 nm with the line of Schroder and Rennenberg, 1992). Definitive activities adjusted as mmole dissipated oxygen in min per mg protein and mmole 1-chloro-2,4-dinitrobenzene (CDNB) in min per mg protein respectively.

Statistical analysis

All of the results obtained from experimental studies were evaluated with SPSS (SPSS Inc, Chicago, IL, USA). The values are the averages of the results of three replicates of each experiment with a standard error (SE). To compare the Enzyme activity and removal efficiencies, the datas were analyzed by analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Determination of pesticide metabolism

Studies for determination methods of metabolism of pesticides in used crops accodingly of used herbicides on the process of detoxification enzymes (cytochrome P450, glutathione stransferase and peroxidase) were fulfilled. In *Zea mays*, nearly all examined enzymes are influenced for modification of Deltamethrin and Fenvalerate, merely the activation of glutathione S-transferase occure for Permethrin (Figure 1-3).

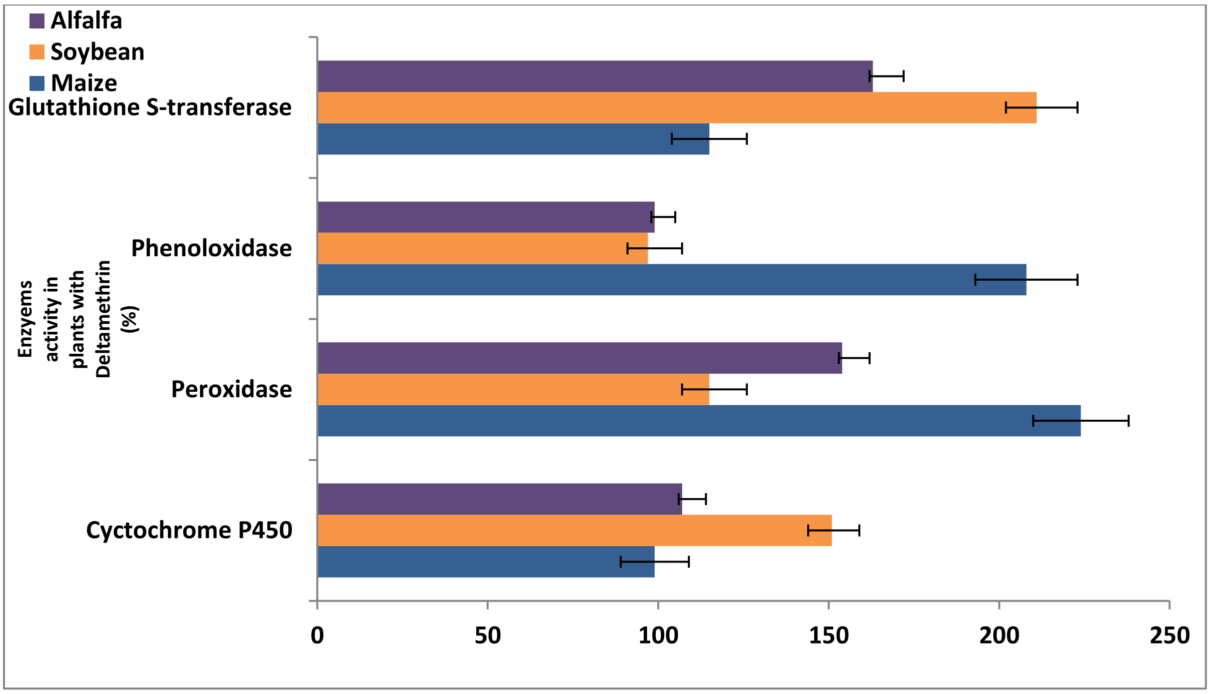

Figure 1: Causation of oxidative enzymes in roots of two weeks old plantings after developing on solution 0.1 mM of Deltamethrin during ten days. The enzymatic activation in control differencies are take into account as full.

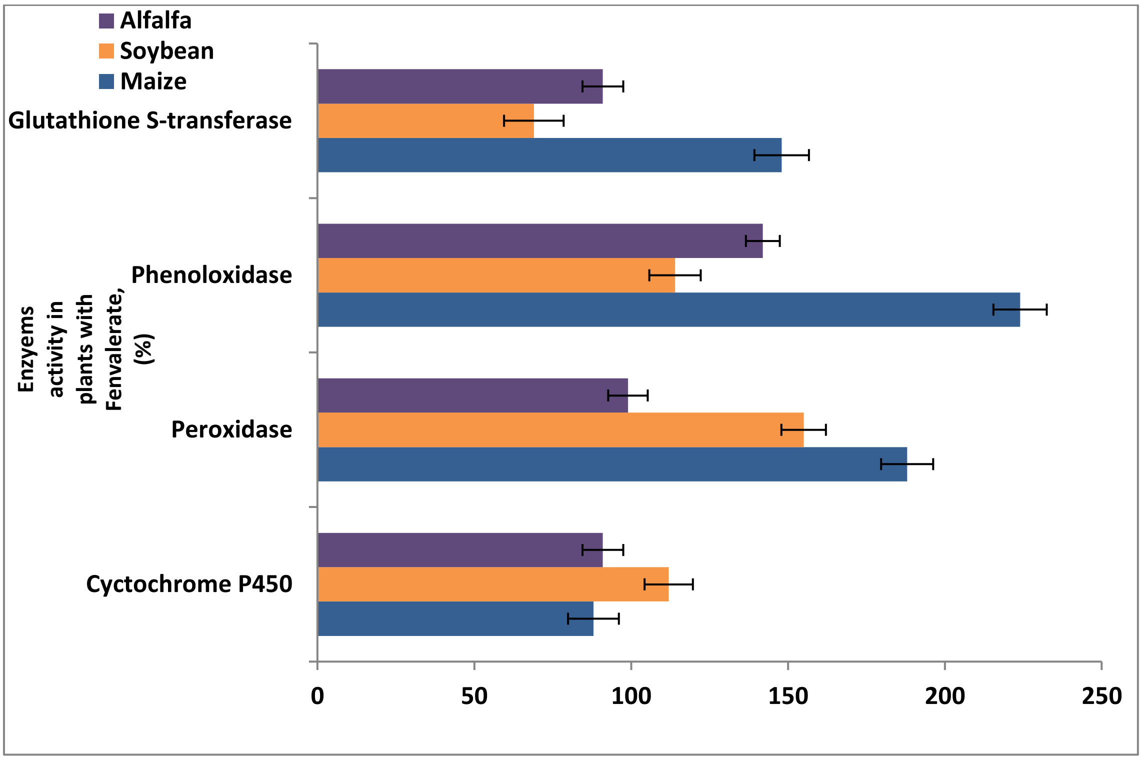

Figure 2: Causation of oxidative enzymes in roots of two weeks old plantings after developing on solution 0.1 mM of Fenvalerate during ten days. The enzymatic activation in control differencies are take into account as full.

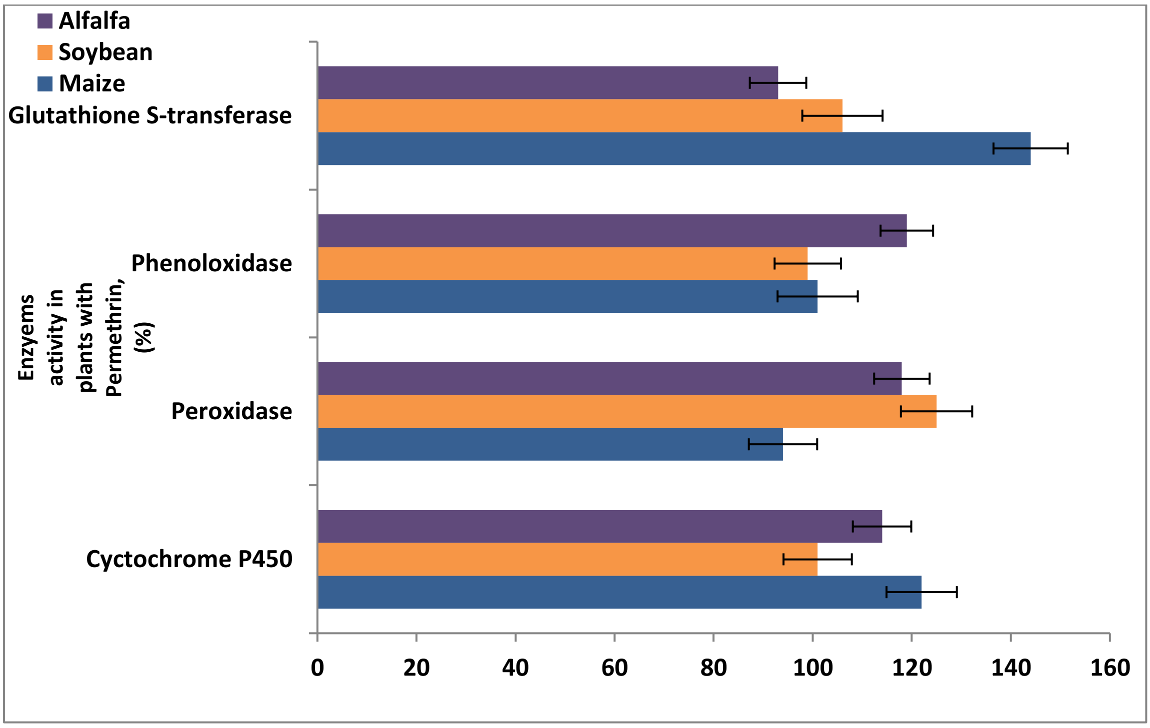

Figure 3: Causation of oxidative enzymes in roots of two weeks old plantings after developing on solution 0.1 mM of Permethrin during ten days. The enzymatic activation in control differencies are take into account as full.

Detoxification of non-polar molecules of Deltamethrin and Fenvalerate, the ineptive subsequent and oxidation junction is essential. Differently from Deltamethrin and Fenvalerate, Permethrin includes polar hydroxyl group and Permethrin can be exposed to manage conjugation with glutathione. Comparable outcomes acquired for another crops or plants, but causation influences like them are less stated. At the outcome of the study, different induction degree of enzymes take part in conjugation and oxidation of studied pesticides action on crops occured. When each detoxification enzyme catalyze conjugation or oxidation response, it is understood that the transformation of studied herbicides in crops develops via various ways. Deltamethrin exposed to first oxidation by peroxidase, monooxygenase, phenoloxidase and subsequent conjugation by glutathion S-transferase and this situation is mainly due to footpath of this pesticides modification. Additionally, these pollutants may be coupled by glutathione S-transferase directly. Fenvalerate exposed to oxidation by monooxygenase, peroxidase or phenoloxidase and subsequent conjugation by glutathione S-transferase primerly. The basic tools of metabolized Permethrin exposed squarely conjugation by glutathion S-transferase and other tools are conjugated after primary oxidation by monooxygenase and peroxidase.

Biomass studies

Microbacterium chocolatum, Ochrobactrum thiophenivorans, Sphingomonas melonis, Sphingomonas aquatilis and *Bacillus subtilis* identified and used for monitoring on solid nutritive area with Deltamethrin, Fenvalerate and Permethrin. According to the results, after cultivation on Deltamethrin contaminated area, *Microbacterium chocolatum* reveals best growth with glucose. In media with Fenvalerate, *Ochrobactrum thiophenivorans* reveals best growth with glucose and at least, *Sphingomonas melonis, Sphingomonas aquatilis* and *Bacillus subtilis* exposes best grown are selected with madium with glucose. After refinement with Permethrin, *Bacillus subtilis* unveils best growth with glucose. The affect of Deltamethrin, Fenvalerate and Permethrin pesticides on biomass accretion by selected bacteria were determined. According to the experimental results, *Microbacterium chocolatum* Deltamethrin, *Ochrobactrum thiophenivorans* in Lindane and *Bacillus subtilis* in Permethrin accumulate biomass higher than on Czapek‘s agar without glucose.

Bioremediation studies

The detoxification capacity of bacteria that related with biomass accretion properties at submerge culture for pesticides containing areas determined. Pesticide residual analyses results gained from GC-ECD, in incubation medium after planting, high pesticide degradation efficiencies of the bacteria have been determinated. These bacteria can biodegrade pollutants from agricultural area with removal efficiency of nearly 80% from suggested concentration for farmers and these results are also can be helpful highly-developed phytoremediation methods. Similar studies for expand of new advance of phytoremediation methods for remediate agricultural fields caused by these type of pesticides have been also investigated. For example, the microbial consortia (Mixture of bacteria and/or fungi) and crops like *soybean, maize* and *alfalfa* studied. Phytoremediation of agricultural soils contaminated by Deltamethrin is very effective with using of *Microbacterium chocolatum* concortia with soybean. Deltamethrin content in agricultural soils decreased by 76%. For phytoremediation of agricultural soils contaminated by Permethrin shows best removal performance using of Bacillus subtilis with maize as 66%. In experiments with Fenvalerate, the content of pesticide residuals decreased by bioremediation capacity of *Ochrobactrum thiophenivorans* and maize by 67% (Figure 4).

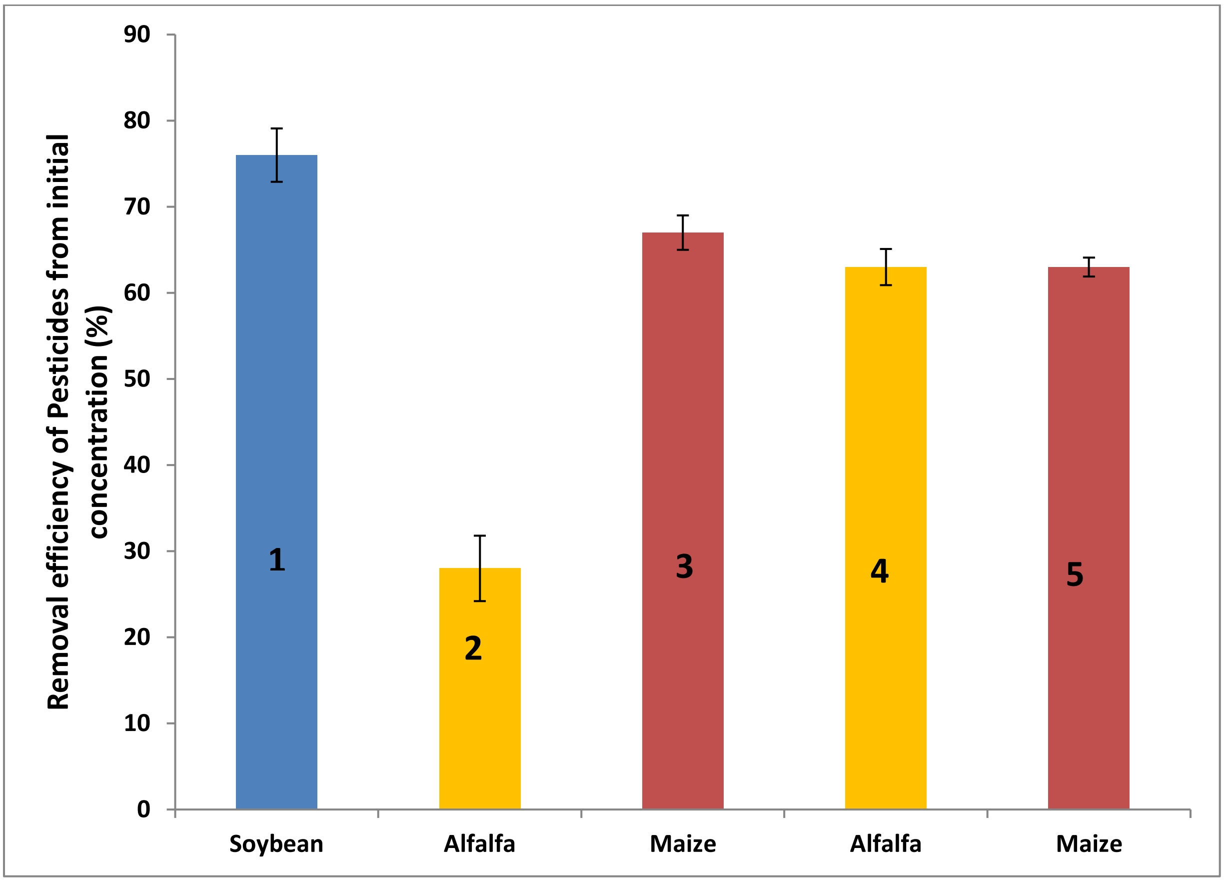

Figure 4: The results of model experiments using bacterial strains and crops for bioremediate agricultural soils contaminated with herbicides. Column 1: Pollutant: Deltamethrin; Bioremediation agent: *Microbacterium chocolatum*; plant: soybean. Column 2: Pollutant: Fenvalerate; Bioremediation agent: *Ochrobactrum thiophenivorans*; Plant: Alfalfa. Column 3: Pollutant: Fenvalerate; Bioremediation agent: *Ochrobactrum thiophenivorans*; Plant: Maize. Column 4: Pollutant: Permethrin; Bioremediation agent: *Bacillus subtilis*; Plant: Alfalfa. Column 5: Pollutant: Permethrin; Bioremediation agent: *Bacillus subtilis*; Plant: Maize.

Thus it can be understood that model studies reveals new technological perspective discovered in recent years is successful for phytoremediation of agricultural lands contaminated by these kind of pesticides. Microorganisms biodegrade persistent organic pollutants and interact with the environment. This issue is important for successfull implementation of the technology for in situ remediation (Hussain et al., 2009).

Herbicide detoxification was first identified by microorganisms that genetically changed and the genes encoding these hydrolases were *Escherichia coli*, *P. Pseudoalcaligene*, *Yarrowia lipolytica*, *Streptomyces lividans* and *Pichia pastoris* (Wang et al., 2012). Different method for bioremediate herbicides is phytoremediation. This method is economically and environmentally friendly (Eapen et al., 2007). In what way, the limitation with crops is that they lack the catabolic pathways for full biodegradation of herbicides. The properties of agricultural crops to biodegrade pesticides encourage by crops via effective genes that are embody in the biodegradation of these toxic pollutants (Singh et al., 2011).

Recent years studies identify that nearly most of the bacteria present in soil and awuatic environmet are not cheerfully culturable and consequently not adaptable for biotechnological studies (Zhou et al., 2010). According to result of some recent studies about biodegradation and phytoremediation of organochlorine pesticides (Lindane, DDT and PCP) on the growth parameters of different crops, the using of these crops for bioremediate soil was not adequate because of low solubility and bioavailability.

For handle with this negativeness, Kurashvili et al. (2014) found a new bioremediation system with high detoxification potential for efficiency reducing the effects of organochlorine pesticides from receiving environment. According to their study, this system based on microorganisms that degrade initial degradation of pesticides with the action of enzymes. Cavka and Jönsson, (2014) found that S. *cerevisiae* strain exhibited the best capability to grow in high concentrations of lignocellulosic media, which indicates that it has better resistance to inhibitors according to other types of fungi. In their study, they found, *P. Pastoris* and *S. cerevisiae* reduced mannose and glucose while the other bacteria or fungi were more varied from a metabolical perspective.

As a results of the experiments, *maize, alfalfa* and *soybean*are qualified with causation of detoxification enzymes like cytochrome P450 containing monooxygenase, peroxidase, glutathione S-transferase and phenoloxidas. It is indicated that the transformation of Deltamethrin, Fenvalerate and Permethrin in plants mainly due to pathways of direct oxidation, or oxidation and subsequent conjugation, or conjugation. According to the experimental results, *alfalfa, maize* and *soybean* as crops remediators and *Sphingomonas melonis, Sphingomonas aquatilis* and *Bacillus subtilis* as biodegrading tools for phytoremediation method aimed to remediate receivig environments contaminated with these type of pesticides have been chosen. As a results of experimental models, the discovered treatment will be alternatively and prevalently used for remediate the receiving environments such as agricultural fields contaminated with these pesticides. The toxicity of parathion-ethyl, diazinon, fenitrothion and biodegradation products of them generated through enzyme hydrolysis was investigated. Each pesticides were confirmed by chromotographic and specthrometric analysis and determined to be in accordance with catalytic mechanisms (Elias et al., 2007), Rodriguez et al., (2010) studied paraoxon-ethyl concentrations up to 800 μM for incubating planarians while concentrations ranging from 13 μM up to 57 μM for recently used pesticides. *D. japonica* for concentrations up to 500 μM was also described and it was found that dichlorvos was 100 times more toxic than chlorpyrifos suggesting that toxicity is strongly dependent on the pesticide (Hagstrom et al., 2015).

CONCLUSION

The results show that *maize, alfalfa* and *soybean* indicate detoxification induction of enzymes used in the study. The transformation of the examined herbicides in crops generally occur through direct oxidation, direct conjugation, or through oxidation and subsequent conjugation pathways. The results indicate that *maize, alfalfa* and *soybean* can be used as plant phytoremediators; some soil bacteria as herbicide biodegradation agents, for decontamination of contamination of an environment caused by herbicides. Thus, according to the results of the model experiments, subsequent biotechnological method is effective in remediating soil from pollution of herbicides. Bacteria also have a similar degradative process of herbicide, and unlike plants they genetically rapidly adapt to chemical substances. The degradation and detoxification potential of microorganisms are being used for contamination of receiving environments caused by a wide variety of pesticides. Additionally, phytoremediation, known as a process where microorganisms and plants jointly detoxify and degrade contaminants resulting in eradication of contaminants.

Bioremediation process for detoxification of herbicides from the contaminated environment has now emerged as the best option. Today, various bioremediation approaches are available to address the problem of decontaminating the environmental compartments from these hitherto essential toxicants at least needed for vector control despite the persistent and recalcitrant nature of several pesticides as well as their associated health hazards. Pest control over the last years had a significant change due to biotechnology techniques and there is a continual exploration of interesting new perspectives.

However, such pesrpectives continue to be reliant on more advances in the microbial of whole-plants. An understanding of the biodegradation mechanism, enzyme expression implicated in herbicide metabolism may solve problems. Finally, our study will help in promoting an appreciation of the environmentally unharmed and commercial applications of herbicides. With high budget projects, changes in the molecular structure of pesticides may be monitored. In addition to this, the differences that ocur in the genes of the microorganisms that are involved in the decomposition process may also be observed. Since agricultural areas include microorganisms which decompose pesticides, studies may be conducted on different pesticides with microorganisms obtained from different agricultural soils.

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