Response of some varieties of Corn (*Zea mays* L.) and liquid bio-fertilizer dosage

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Abstract. The Central Bureau of Statistics (2013) corn production in Indonesia in 2012 amounted to 19.37 million tons, but Indonesia still imported 3.2 million tons of corn from abroad. The cause of the decline in corn production is due to climate change and nutrient-deficient (dry) land conditions. Rhizobaktery biological fertilizers have the ability to increase plant drought tolerance, increase crop production and produce growth hormone IAA. The aim of the study was to determine the interaction between the types of corn plant varieties and the doses of liquid biofertilizers, the effect of the types of varieties and the effects of liquid biofertilizer doses on the growth and yield of corn plants. Methods include bacterial propagation, biofertilizer production, cultivation according to recommendations and statistical analysis of Split Plot Design with 5% HSD follow-up test. The results indicated interactions between treatments of corn varieties and liquid biofertilizer doses on dry land. Corn variety had a significant effect on the Bisi 99 treatment on the growth and yield of corn plants. Liquid biological fertilizer had a significant effect, the 50 ml dose treatment was the best for corn yields, while the 100 ml dose treatment was the best for corn growth.

1 Introduction

Corn is a food crop widely cultivated in Indonesia for self-sufficiency. According to the Central Statistics Agency (2013), Indonesia produced 19.37 million tons of corn in 2012. Indonesia still imports 3.2 million tons of corn from abroad. One of the things that can cause a decrease in corn production is climate change and land conditions that lack nutrients (dry).[1]

Indonesia has a dry land area of 144.47 million ha; around 99.65 million ha (68.98%) is potential land for agriculture, while the remaining 44.82 million ha has no potential for agriculture, mostly due to constraints in the form of limited water content. So, corn cultivation on this land is limited, the changing climate and dry land decrease nutrient availability for plants, and changes in land ecosystems can increase pest attacks and plant diseases [2]. The increase in pests and diseases is causing problems for farmers, resulting in cultivation costs soaring and land being damaged due to excessive application of inorganic

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fertilizer, resulting in sedimentation on the land. In this research, biofertilizers will be made to improve soil fertility and increase plant productivity under drought stress on dry land.

This biological fertilizer, namely Rhizobacteria, is used to expand plant land capacity and increase plant production by increasing plant tolerance to drought. Rhizobacteria can produce the growth hormone IAA, which makes them useful as biofertilizers. Indole acetic acid (IAA) has the power to accelerate plant growth by strengthening the root system, accelerating the emergence of young roots, and increasing the capacity of cells to absorb water. This increases the water potential of the tissue, which causes cells to elongate [3]. Thus, this biological fertilizer has excellent potential for dry land because it can increase plant growth and resistance to drought and plant yields on dry land [3]. This research aims to obtain the best treatment of liquid biofertilizer to be used on some varieties of corn on dry land.

2 Materials and Methods

2.1 Materials

The materials used in this research were isolates containing the bacteria *Raoultella terrigena, Serratia marcescens, Serratia nematodiphila, Enterobacter hormaechei, Enterobacter cancerogenus, Enterobacter cloacae, Enterobacter asburiae, Citrobacter murliniae, and Pseudomonas fluorescens*. 4 varieties of corn plants consisted of the Bisi 18 variety, the Bisi 99, Pertiwi 6 variety, Pertiwi 3 variety, rhizobacteria isolate, distilled water, red growmore, green growmore, water, glucose, Nutrient broth, NaCl, manure as basic fertilizer, liquid biofertilizer, chlorox, tissue, soil samples, alcohol 96 %, 25 kg Phonska fertilizer,25 kg Za fertilizer, 25 kg Urea fertilizer, Gramoxone, calaris, Sapporo, decis, regent, Bayfolan, Supermes, Atonik, Gandasil D, Gandasil B, Dithane, Amistartop, Agrister.

The tools used are fermenters, conductors, buckets, scissors, sacks, staples, buckets, meters, laboratory equipment including petri dishes, measuring cups, Erlenmeyer, test tubes, 1000 ml beakers, dropper pipettes, Laminar Air Flow (LAF), knives, sprayers, shakers, preparations, spatulas, water pumps, UV lamps, agricultural tools on the land including hoe planters, jugs, picks, sickles, buckets, meters, bamboo, alvaboard, plastic, glue, bottles plastic, raffia rope, laptop, stationery, transportation equipment and documentation equipment.

2.2 Methods

The experimental design used was a split-plot design. The main factor (Main plot) is corn variety (V), and the nested factor (Subplot) is liquid dose (P). The main plot is a plant variety consisting of 4 levels, namely the Bisi 18 variety (V1), the Bisi 99 variety (V2), the Pertiwi 6 variety (V3), the Pertiwi 3 variety (V4), and a subplot namely the dose of water fertilizer (P) which consists of 4 levels, namely without treatment dose (P0) dose of liquid biological fertilizer 50 g/plant (P1) dose of granular biofertilizer 100 g/plant (P2) dose of granular biofertilizer 150 g/plant (P3), population of 18 plants per treatment and five observation samples taken randomly.

The data obtained is analyzed using the F test or Anova method with a factorial split-plot design, then for further testing using the Honest Significant Difference (HSD) with a level of 5% to compare the effects between treatments. Testing was conducted using Minitab 18, IBM SPSS Statistics 26, and Microsoft Excel 2019 software.

3 Results

3.1 Corn Plant Height

Based on the ANOVA table between the application of liquid biological fertilizer to several varieties of corn, it shows that the interaction is not significant at 14 DAP, while the interaction between ages 21 and 49 DAP is very significant. The average test of applying liquid biological fertilizer to several corn varieties on plant height can be seen in Table 1 and Table 2:

Table 1 Average Value of Corn Plant Height When Treated with Liquid Biological Fertilizer at 14 DAP Observations

Treatment	Average
Variety	**Plant Height (cm) 14 DAP**
V1 (Bisi 18 Variety)	22,96b
V2(Bisi 99 Variety)	20,76a
V3(Pertiwi 6 Variety)	23,23b
V4(Pertiwi 3 Variety)	23,13b
HSD 5%	**0,47**
Fertilizer Type	
P0 (Control)	21,04a
P1 (Liquid fertilizer 50ml)	23,04bc
P2 (Liquid fertilizer 100ml)	23,49c
P3 (Liquid fertilizer 150ml)	22,51bc
HSD 5%	**0,64**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

Table 2 Average Value of Corn Plant Height Given Liquid Biological Fertilizer Treatment at 21 DAP, 28 DAP, 35 DAP, 42 DAP, 49 DAP

Treatment	Average Plant Height (cm)				
	21 DAP	**28 DAP**	**35 DAP**	**42 DAP**	**49 DAP**
V1(Bisi 18) P1(50 ml)/plant	41,20b	69,87a	93,53b	109,60a	119,73a
V1(Bisi 18) P2(100 ml)/plant	42,20b	74,50bc	97,40c	107,73a	121,80ab
V1(Bisi 18) P3(150 ml/plant	45,27d	73,70b	99,87cd	118,87b	134,67d
V2(Bisi 99) P1(50 ml)/plant	38,00a	74,07b	91,13b	118,93b	148,47ef
V2(Bisi 99) P2(100 ml)/plant	43,73c	69,60a	101,33de	138,63e	161,20g
V2(Bisi 99) P3(150 ml)/plant	38,53a	69,20a	85,67a	107,87a	128,13c
V3(Pertiwi 6) P1(50 ml)/plant	47,60e	75,20bc	103,47ef	109,00a	122,00ab
V3(Pertiwi 6) P2(100 ml)/plant	45,60d	76,40cd	108,87g	116,80b	127,20bc
V3(Pertiwi 6) P3(150 ml)/plant	49,20f	76,47cd	105,33fg	119,13bc	128,27c
V4(Pertiwi 3) P1(50 ml)/plant	45,73d	80,60f	105,47fg	121,07bc	143,33e
V4(Pertiwi 3) P2(100 ml)/plant	46,47de	80,10ef	108,33g	131,80d	150,00f
V4(Pertiwi 3) P3(150 ml)/plant	45,87d	78,33de	106,27fg	123,40c	146,60ef
HSD 5%	**1,50**	**2,14**	**3,58**	**4,29**	**5,69**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.2 Corn Plant Stem Diameter

Based on the ANOVA table between the application of liquid biofertilizer to several varieties of corn shows a real interaction between the ages of 14 DAP, while it is genuine at the age of 21 DAP to 49 DAP. The average test of applying liquid biological fertilizer to several varieties of corn plants on stem diameter can be seen in Table 3:

Table 3 Average Value of Corn Stem Diameter When Treated with Liquid Biological Fertilizer at Each Observation

Treatment	Average Stem Diameter (mm)					
	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	49 DAP
V1(Bisi 18) P1(50 ml)/plant	5,77ab	9,59ab	15,55a	17,57a	17,75a	18,41a
V1(Bisi 18) P2(100 ml)/plant	5,91abc	9,35a	15,61ab	17,67ab	18,01ab	18,91ab
V1(Bisi 18) P3(150 ml/plant	6,97e	10,37g	15,67ab	17,87ab	18,77c	19,33b
V2(Bisi 99) P1(50 ml)/plant	6,11bc	9,77bc	16,05b	18,34c	19,05c	20,97de
V2(Bisi 99) P2(100 ml)/plant	5,99abc	9,57ab	15,54a	18,37c	20,81e	21,15de
V2(Bisi 99) P3(150 ml)/plant	5,75ab	9,39a	15,57a	17,69ab	18,99c	19,22b
V3(Pertiwi 6) P1(50 ml)/plant	5,92abc	10,07def	17,23d	20,12e	21,11e	21,41e
V3(Pertiwi 6) P2(100 ml)/plant	5,72a	9,93cd	16,63c	18,89d	20,02d	20,88d
V3(Pertiwi 6) P3(150 ml)/plant	6,26cd	10,33fg	17,33d	20,52f	21,87f	22,12f
V4(Pertiwi 3) P1(50 ml)/plant	6,17cd	10,02cde	15,77ab	18,75d	19,38cd	20,12c
V4(Pertiwi 3) P2(100 ml)/plant	6,59d	10,26efg	17,43d	20,03e	20,81e	21,33de
V4(Pertiwi 3) P3(150 ml)/plant	6,20c	10,10defg	15,69ab	17,95b	18,71bc	19,25b
HSD 5%	**0,37**	**0,28**	**0,43**	**0,32**	**0,70**	**0,51**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.3 Number of Corn Plant Leaves

Based on the ANOVA table between the application of liquid biofertilizer to several varieties of corn, it shows a real interaction at the age of 14 DAP, 21 DAP, and 49 DAP while at the age of 28 DAP, 35 DAP, and 42 DAP, the interaction is very significant. The average test of applying liquid biological fertilizer to several varieties of corn plants on the number of leaves can be seen in Table 4:

Table 4 Average value of the number of corn leaves given liquid biological fertilizer treatment at each observation

Treatment	Average Number of Leaves (pieces)					
	14 DAP	**21 DAP**	**28 DAP**	**35 DAP**	**42 DAP**	**49 DAP**
V1(Bisi 18) P1(50 ml)/plant	4,73a	6,00bcde	6,60cde	6,87bcd	7,27a	7,67a
V1(Bisi 18) P2(100 ml)/plant	4,60a	6,20de	6,53cd	6,93bcd	7,27a	7,80ab
V1(Bisi 18) P3(150 ml/plant	5,33c	6,13cde	6,80e	7,00cd	7,67c	8,00bc
V2(Bisi 99) P1(50 ml)/plant	4,80ab	5,60a	6,27b	7,67fg	8,40e	8,60fg
V2(Bisi 99) P2(100 ml)/plant	4,80ab	5,60a	6,00a	7,40ef	8,27e	8,80g
V2(Bisi 99) P3(150 ml)/plant	4,67a	5,93bcd	6,00a	7,07de	7,93d	8,20cde
V3(Pertiwi 6) P1(50 ml)/plant	4,80ab	6,27e	6,53cd	6,67bc	7,40ab	8,27de
V3(Pertiwi 6) P2(100 ml)/plant	4,80ab	5,87abc	6,00a	6,13a	7,33a	8,13cd
V3(Pertiwi 6) P3(150 ml)/plant	5,00b	6,27e	6,53cd	6,60b	7,80cd	8,80g
V4(Pertiwi 3) P1(50 ml)/plant	4,80ab	5,80ab	6,73de	6,87bcd	7,80cd	8,40ef
V4(Pertiwi 3) P2(100 ml)/plant	4,80ab	6,00bcde	6,67de	7,93g	8,00d	8,60fg
V4(Pertiwi 3) P3(150 ml)/plant	4,80ab	6,00bcde	6,40bc	7,07de	7,60bc	8,60fg
HSD 5%	**0,25**	**0,27**	**0,24**	**0,33**	**0,21**	**0,25**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.4 Age of Appearance of Male and Female Flowers of Corn Plants

Based on the ANOVA table between the application of liquid biological fertilizer to several varieties of corn, it shows a real interaction in the age at which male and female flowers appear. The average test of application of liquid biological fertilizer to several varieties of corn plants on the age at which male flowers emerge can be seen in Table 5:

Table 5 Average Value of Age of Appearance of Male and Female Flowers Given Liquid Biological Fertilizer Treatment at Each Observation

Treatment	Average	
	Age of Male Flower Appearance (DAP)	**Age of Female Flower Appearance (DAP)**
V1(Bisi 18) P1(50 ml)/plant	54,53cd	58,20ab
V1(Bisi 18) P2(100 ml)/plant	54,00bcd	57,80a
V1(Bisi 18) P3(150 ml/plant	53,80bcd	58,60bc
V2(Bisi 99) P1(50 ml)/plant	55,00d	57,87a
V2(Bisi 99) P2(100 ml)/plant	54,47cd	57,67a

V2(Bisi 99) P3(150 ml)/plant	46,87a	58,00a
V3(Pertiwi 6) P1(50 ml)/plant	55,60d	61,33f
V3(Pertiwi 6) P2(100 ml)/plant	52,47bc	59,60de
V3(Pertiwi 6) P3(150 ml)/plant	52,33b	59,07cd
V4(Pertiwi 3) P1(50 ml)/plant	54,80d	59,67e
V4(Pertiwi 3) P2(100 ml)/plant	54,67d	58,73bc
V4(Pertiwi 3) P3(150 ml)/plant	55,00d	59,6de
HSD 5%	**2,09**	**0,59**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.5 Location of Corn Plant Cobs

The ANOVA table shows a real interaction between the application of liquid biofertilizer and several varieties of corn at 56 DAP and 63 DAP observations, while the effect is very real in observations from 70 DAP to 105 DAP. The average test of applying liquid biological fertilizer to several varieties of corn plants on the location of the cob can be seen in Table 6:

Table 6 Average value of corn cob location given liquid biological fertilizer treatment at each observation

Treatment	**Average Cob Location (cm)**							
	56 DAP	**63 DAP**	**70 DAP**	**77 DAP**	**84 DAP**	**91 DAP**	**98 DAP**	**105 DAP**
V1(Bisi 18) P1(50 ml)/plant	83,47b	97,40bc	100,60b	103,33c	105,33b	106,80b	107,20b	106,93b
V1(Bisi 18) P2(100 ml)/plant	85,47bc	93,20a	95,40a	97,20a	99,33a	101,80a	102,33a	102,33a
V1(Bisi 18) P3(150 ml/plant	89,87cd	94,47ab	96,67a	99,67b	101,93a	102,93a	102,93a	102,73a
V2(Bisi 99) P1(50 ml)/plant	95,47efg	101,27d	101,93b	108,27d	110,93c	112,13cd	112,53cd	110,53cd
V2(Bisi 99) P2(100 ml)/plant	100,00g	111,53f	113,87e	115,20f	118,87e	119,73e	120,00e	118,60e
V2(Bisi 99) P3(150 ml)/plant	98,27fg	101,20d	106,33c	108,73d	111,73cd	112,73cd	113,20cd	112,20cd
V3(Pertiwi 6) P1(50 ml)/plant	72,40a	94,73ab	96,67a	98,93ab	101,27a	102,60a	103,00a	102,47a
V3(Pertiwi 6) P2(100 ml)/plant	92,13de	99,67cd	101,60b	103,90c	105,90b	106,90b	107,53b	106,93b
V3(Pertiwi 6) P3(150 ml)/plant	71,53a	92,47a	95,40a	97,40ab	99,73a	101,07a	101,80a	100,40a
V4(Pertiwi 3) P1(50 ml)/plant	96,93efg	108,93ef	111,00de	109,13de	113,13d	114,13d	114,53d	114,13d
V4(Pertiwi 3) P2(100 ml)/plant	100,13g	108,80ef	108,67cd	109,07de	109,67c	110,67c	111,07c	110,33c
V4(Pertiwi 3) P3(150 ml)/plant	93,87def	107,53e	110,93d	111,20e	114,07d	115,07d	115,53d	114,47d
HSD 5%	**4,95**	**3,32**	**2,92**	**2,39**	**3,23**	**3,16**	**3,11**	**3,09**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.6 Weight of Corn Cobs with Husks and Without Husks

Based on the ANOVA table between the application of liquid biological fertilizer to several varieties of corn, it shows a very significant effect on the weight parameters of cobs with husks and without husks. The average test of applying liquid biological fertilizer to several varieties of corn on the weight of husk cobs can be seen in Table 7:

Table 7 Average Value of Weight of Cobs with Husks and Without Husks Given Liquid Biological Fertilizer Treatment at Each Observation

Treatment	**Average**	
	Weight of Cobs With Husks (gram)	**Weight of Cobs Without Husks (gram)**
V1(Bisi 18) P1(50 ml)/plant	200,60bc	177,47b
V1(Bisi 18) P2(100 ml)/plant	195,47b	175,53b
V1(Bisi 18) P3(150 ml/plant	211,40d	180,33bc
V2(Bisi 99) P1(50 ml)/plant	27,340h	239,93g
V2(Bisi 99) P2(100 ml)/plant	245,47g	219,87f
V2(Bisi 99) P3(150 ml)/plant	236,13f	205,33e
V3(Pertiwi 6) P1(50 ml)/plant	169,47a	150,73a
V3(Pertiwi 6) P2(100 ml)/plant	161,07a	154,33a
V3(Pertiwi 6) P3(150 ml)/plant	210,33d	184,53cd
V4(Pertiwi 3) P1(50 ml)/plant	228,07e	203,33e
V4(Pertiwi 3) P2(100 ml)/plant	235,20f	206,27e
V4(Pertiwi 3) P3(150 ml)/plant	203,53c	188,07d
HSD 5%	**6,12**	**7,22**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.7 Length of Corn Cobs with Husks and Without Husks

Based on the ANOVA table between the application of liquid biofertilizer to several varieties of corn shows a real interaction in observing the length of cobs with husks and without husks. The average test of applying liquid biological fertilizer to several varieties of corn on the length of husk cobs can be seen in Table 8:

Table 8 Average Value of Length of Cobs with Husks and Without Husks Given Liquid Biological Fertilizer Treatment at Each Observation

Treatment	**Average**	
	Length of Cobs With Husks (cm)	**Length of Cobs Without Husks (cm)**
V1(Bisi 18) P1(50 ml)/plant	20,70a	13,45a
V1(Bisi 18) P2(100 ml)/plant	21,77bc	13,52ab
V1(Bisi 18) P3(150 ml/plant	21,27ab	13,45a
V2(Bisi 99) P1(50 ml)/plant	27,93g	17,22f
V2(Bisi 99) P2(100 ml)/plant	27,05f	16,13e
V2(Bisi 99) P3(150 ml)/plant	27,26f	16,66e
V3(Pertiwi 6) P1(50 ml)/plant	23,06d	13,39a
V3(Pertiwi 6) P2(100 ml)/plant	24,63e	13,81abc
V3(Pertiwi 6) P3(150 ml)/plant	24,34e	14,87d
V4(Pertiwi 3) P1(50 ml)/plant	21,30b	14,03bc
V4(Pertiwi 3) P2(100 ml)/plant	21,77bc	13,53ab
V4(Pertiwi 3) P3(150 ml)/plant	22,07c	14,10c
HSD 5%	**0,57**	**0,56**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.8 Cob Diameter and Number of Cob Rows

The ANOVA table shows a real interaction between the application of liquid biological fertilizer to several varieties of corn plants by observing the diameter of the cob and the number of rows of cobs. The average test of applying liquid biological fertilizer to several varieties of corn on the length of husk cobs can be seen in Table 9:

Table 9 Average value of cob diameter and number of cob rows given liquid biological fertilizer treatment at each observation

Treatment	**Average**	
	Cob Diameter (mm)	**Number of Rows of Cobs (Pieces)**
V1(Bisi 18) P1(50 ml)/plant	46,01a	14,20de
V1(Bisi 18) P2(100 ml)/plant	46,79ab	14,33def
V1(Bisi 18) P3(150 ml/plant	46,99ab	14,73f
V2(Bisi 99) P1(50 ml)/plant	48,34c	14,13cde
V2(Bisi 99) P2(100 ml)/plant	47,53bc	14,33def
V2(Bisi 99) P3(150 ml)/plant	46,83ab	13,67bc
V3(Pertiwi 6) P1(50 ml)/plant	46,19a	13,60b
V3(Pertiwi 6) P2(100 ml)/plant	46,09a	13,07a
V3(Pertiwi 6) P3(150 ml)/plant	47,77bc	13,87bcd
V4(Pertiwi 3) P1(50 ml)/plant	52,45e	15,27g

V4(Pertiwi 3) P2(100 ml)/plant	53,54f	15,27g
V4(Pertiwi 3) P3(150 ml)/plant	51,37d	14,40ef
HSD 5%	**1,03**	**0,51**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.9 Dry Weight

The ANOVA table shows that the application of liquid biological fertilizer to several varieties of corn plants has a very significant effect on dry weight parameters. The average test of applying liquid biological fertilizer to several varieties of corn plants on dry weight can be seen in Table 10:

Table 10 Average Dry Weight Value of Corn Plants Treated with Liquid Biological Fertilizer at Each Observation

Treatment	**Average**
	Dry Weight (gram)
V1(Bisi 18) P1(50 ml)/plant	142,87bc
V1(Bisi 18) P2(100 ml)/plant	137,87b
V1(Bisi 18) P3(150 ml/plant	136,07b
V2(Bisi 99) P1(50 ml)/plant	206,93g
V2(Bisi 99) P2(100 ml)/plant	167,07e
V2(Bisi 99) P3(150 ml)/plant	155,47d
V3(Pertiwi 6) P1(50 ml)/plant	120,13a
V3(Pertiwi 6) P2(100 ml)/plant	118,67a
V3(Pertiwi 6) P3(150 ml)/plant	153,73d
V4(Pertiwi 3) P1(50 ml)/plant	163,87e
V4(Pertiwi 3) P2(100 ml)/plant	173,07f
V4(Pertiwi 3) P3(150 ml)/plant	144,67c
HSD 5%	**8,03**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.10 Tip Filling

Based on the ANOVA table, the application of liquid biological fertilizer to several varieties of corn plants shows a significant effect on the tip-filling parameters. The average test of applying liquid biological fertilizer to several varieties of corn plants on tip filling can be seen in Table 11:

Table 11 Average Value of Corn Plant Tip Filling for Liquid Biological Fertilizer Treatment at Each Observation

Treatment	**Average**
	Tip Filling (%)
V1(Bisi 18) P1(50 ml)/plant	97,20cd
V1(Bisi 18) P2(100 ml)/plant	97,53cde
V1(Bisi 18) P3(150 ml/plant	97,00bc
V2(Bisi 99) P1(50 ml)/plant	98,00ef
V2(Bisi 99) P2(100 ml)/plant	97,60cdef
V2(Bisi 99) P3(150 ml)/plant	95,47a

V3(Pertiwi 6) P1(50 ml)/plant	97,13b
V3(Pertiwi 6) P2(100 ml)/plant	96,40b
V3(Pertiwi 6) P3(150 ml)/plant	97,53cde
V4(Pertiwi 3) P1(50 ml)/plant	98,27f
V4(Pertiwi 3) P2(100 ml)/plant	97,87def
V4(Pertiwi 3) P3(150 ml)/plant	97,47cde
HSD 5%	**0,70**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

3.11 Weight of 100 Grains

Based on the ANOVA table between the application of liquid biological fertilizer to several varieties of corn, it shows a very significant effect on the weight parameter of 100 grains. The average test of applying liquid biological fertilizer to several varieties of corn plants for the weight of 100 grains can be seen in Table 12:

Table 12 Average Weight Value of 100 Corn Grains Treated with Liquid Biological Fertilizer at Each Observation

Treatment	**Average**
	Weight of 100 Grains (gram)
V1(Bisi 18) P1(50 ml)/plant	42,63d
V1(Bisi 18) P2(100 ml)/plant	38,80c
V1(Bisi 18) P3(150 ml/plant	38,46c
V2(Bisi 99) P1(50 ml)/plant	35,96a
V2(Bisi 99) P2(100 ml)/plant	35,51a
V2(Bisi 99) P3(150 ml)/plant	37,28b
V3(Pertiwi 6) P1(50 ml)/plant	46,47e
V3(Pertiwi 6) P2(100 ml)/plant	47,32e
V3(Pertiwi 6) P3(150 ml)/plant	46,25e
V4(Pertiwi 3) P1(50 ml)/plant	51,20f
V4(Pertiwi 3) P2(100 ml)/plant	50,41f
V4(Pertiwi 3) P3(150 ml)/plant	53,73g
HSD 5%	**1,17**

Note: Numbers followed by the same letter in the same column indicate that they have no real effect based on the HSD test at the 5% level.

4 Discussion

4.1 Vegetative Phase

Based on the results of ANOVA data analysis using HSD 5% liquid biological fertilizer treatment with the highest mean (161.20) in the 100 ml treatment (P2) with the Bisi 99 variety when compared to the lowest mean (119.73) in the control treatment (P1) of the Bisi 18 variety, where a dose of 100 ml (P2) with the Bisi 99 variety is a treatment combination that can increase the height of corn plants. The biological fertilizer used contains one of the rhizospheric bacteria, which is thought to act as a P phosphate solvent, namely *Serratia nematodiphila*, where corn plants will use the P nutrient for their growth. According to [4], it shows that plant height is influenced by the application of *Serratia nematodiphila* bacteria, which act as a phosphate solvent at the age of 28 DAP and 42 DAP; the type of phosphate solubilizing bacteria has a significant effect on plant height. Rhizosphere bacteria contain N elements, which encourage and accelerate plant growth and increase in height [5].

Based on the results of ANOVA data analysis, liquid biofertilizer treatment was given with the most outstanding results for stem diameter parameters at the age of 49 dap; the treatment combination was 150 ml (P3) of the Pertiwi 6 variety, while the lowest was the combination of Bisi 18 (P1) 50 ml, where the biofertilizer dose was 150 ml (P3) with the Pertiwi 6 variety is a combination of treatments that can increase the diameter of corn stalks. In this study, liquid biofertilizer was administered to the rhizosphere to contain Enterobacter bacteria. According to [6], these bacteria can dissolve the nutrient potassium (K), which can bind the nutrient potassium (K) in the soil. In corn plants, the K nutrient is needed for plant growth to increase plant height and plant stem diameter [5]. Apart from dissolving K nutrients, it is also thought to be able to produce the hormone IAA and fix N, as is the case with Pseudomonas rhizosphere bacteria; according to [7] in their research, *Pseudomonas rhizosphere* bacteria can be able to fix nitrogen, producing IAA, increasing root production by increasing nitrogen absorption from soil influences the growth of plant stem diameter.

Based on the results of ANOVA analysis using 5% HSD, liquid biological fertilizer was given for the highest average number of leaves in the 100 ml treatment combination (P2) of the Bisi 99 variety aged 49 days after planting (8.80) when compared with the lowest average number of leaves in the 50 ml treatment combination (P1) variety Bisi 18 (7.67). The application of liquid biological fertilizer used by rhizosphere bacteria increases the growth of the number of leaves. According to [5], being able to fix N is useful for increasing the number of leaves, broader leaves, larger stem diameter, and longer internode length, resulting in higher plant weight. Based on the above table, the number of leaves aged 21 DAP and 28 DAP was not significantly different. The liquid biofertilizer used in the research contained Serratia nematodiphila bacteria, according to [4], explaining that the rhizosphere bacteria did not differ significantly at 28 days after the number of leaves.

4.2 Generative Phase

Based on the results of ANOVA data analysis, liquid biofertilizer treatment was given in the generative phase, and the flowers of corn plants appeared. The fastest male flowers appeared in the combination without treatment (P3) of the Bisi 99 variety around 46-47 DAP, and the slowest in the Pertiwi 6 50 ml variety combination (P1) with an intensity time of 55-56 DAP. Meanwhile, female flowers appeared the fastest in the treatment combination of 100 ml of the Bisi 99 variety at the age of 57-58 days after planting and appeared late on the 61st day after the combination of the Pertiwi 6 variety 50 ml (P1). Treatment in liquid biofertilizer research using rhizosphere bacteria, the opinion of [9] explains that rhizosphere bacteria have PGPR capabilities including dissolving phosphorus (P), fixing N, producing secondary metabolites such as enzymes and producing IAA phytohormones. Phosphorus (P) is an essential fertilizer that is needed by plants in large quantities. The opinion of [10] explains that P functions in forming fruit, flowers, and seeds.

Based on the results of ANOVA data analysis using 5% HSD treatment with liquid biological fertilizer, determining the highest average point of cob location in the 100 ml treatment combination (P2) of the Bisi 99 variety aged 98 DAP (120) did not experience a significant difference with 91 DAP (119.73), time age 105 DAP (118.60), then from this event there was a decrease in the location of the cob due to ripening of the fruit on the corn plant. It is suspected that the administration of rhizosphere bacteria in this study is capable of producing IAA, according to [11] that rhizobacteria have the ability to produce the phytohormone IAA, dissolve phosphate (P), and fix N from the air. The opinion of [12] states that cob formation is greatly influenced by the IAA element, in cob formation an essential stage of corn crop yield. Research [4] states that the nutrient P supports generative growth in increasing the weight of potato tubers. According to [13], the nutrient N also influences the beginning of the generative phase and can improve the reproductive organs, resulting in maximum productivity results.

4.3 Post-harvest

Based on the results of the ANOVA analysis, we observed the parameters of the weight of the cobs with husks and the weight of the cobs without husks. It was found that the heaviest average results were in the combination of the Bisi 99 variety treated with 50 ml (P1) (273.40) for those with husks, while those without husks (239.93) were quite different from the two parameters (33.47).) is the highest mean when compared with the lowest mean for the combination of the Pertiwi 6 dose (P2) variety (161.07) with cloves, while the one without cloves (154.33) is quite comparable (6.74). In research using the application of biological fertilizers that use rhizosphere bacteria, including *Serratia marcescens, Serratia nematodiphila*, and the Enterobacteriaceae family of bacteria, these bacteria function as phosphate (P) solvents, according to [14], which are capable of producing IAA, dissolving phosphate, fixing nitrogen from bacterial isolate. Research [4] stated that the type of phosphate solubilizing bacteria applied to potato plants effectively increased tuber weight.

Based on the results of the ANOVA analysis, observations of the dry weight parameters of the cobs obtained the highest mean for the combination of the Bisi 99 variety treated with 50 ml biofertilizer (P1) (206.93), which could be compared to the lowest mean for the Pertiwi 6 (P2) variety (118.67). Apart from dry weight, we also observed the weight parameters of 100 grains. The highest mean was obtained with the combination of Pertiwi 3, giving 150 ml liquid biological fertilizer (P3) (53.73) compared to the lowest mean in the treatment (P2) of the Bisi 99 variety (35.51). The application of biological fertilizer for rhizosphere bacteria includes *Serratia marcescens* and *Serratia nematodiphila*, according to [15], who said that the *Serratia spp*. group, apart from increasing the availability of P, can also fix nitrogen. It is suspected that the nitrogen nutrient (N) contained in the bacteria used affects the weight of the cob, according to the opinion of [13], who explains that the provision of the nutrient N contained in the bacteria has a very significant effect on the length and weight of the cob. It is suspected that surrounding corn plants with weeds influences the dry shell weight of the plants. This is in accordance with research [16] that planting corn that is planted free of weeds and covered with soil at wide spacing can increase corn production compared to plants that grow in limited space due to competition with weeds and close spacing. It is suspected that another factor is that irrigation techniques on dry land need to take into account limited rainfall conditions because the rain is uncertain, causing the needs of corn plants on large areas of land not to be met, resulting in plant growth and yields not being optimal[17].

Based on the results of the ANOVA analysis, the parameters for cob length with husks and length without husks were carried out, and the longest average results were obtained for the treatment combination of 50 ml (P1) of the Bisi 99 variety (27.93) for husks, for those without husks (17.22) there was quite a big difference (10.71). When compared to the shortest mean for the combination of the Bisi 18 (P1) variety (20.70) with husks and without husks (13.45), it is quite different (7.25). The liquid biofertilizer treatment in the research used rhizobacteria isolates, which had an effect on cob length due to bacteria that were thought to be able to dissolve P, according to [12] explaining that phosphorus was able to have an influence on cob length. Apart from that, rhizobacteria can fix nitrogen, according to [18], who said that this increase occurs because of the role of rhizobacteria, which can fix N from the air and fertilizer so that they can supply the N nutrient needs of plants for production. According to [19], N fertilizer is an essential nutrient for plants because it is needed for plant growth and corn productivity.

Based on the results of the ANOVA analysis, the parameters of cob diameter and number of rows were observed to obtain the highest mean combined with the Pertiwi 3 variety, dose of 100 ml (P2) (53.54) for diameter, (15.27) for number of rows. When compared with the lowest in the Bisi 18 (P1) variety treatment (46.01) for diameter, (13.07) for number of rows. Meanwhile, the cob filling level had the highest average in the combination of the Pertiwi variety 3 50 ml liquid biofertilizer (P1) (98.27), while the lowest average obtained in the treatment (P1) was the Bisi 99 variety (95.47). One of the rhizosphere bacteria used is thought to have a role as a K solvent, namely *Enterobacter hormaechei*, where potassium can increase plant growth and yield, in accordance with the opinion of [6] explaining that the *Enterobacter hormaechei* bacteria as a K solvent is used as a biological fertilizer to increase the availability of potassium. In the soil, it is also absorbed, increasing the growth and yield of rice. It is suspected that the factor of imperfect cob formation resulting in fewer full seeds also affects corn production due to a lack of essential nutrients in corn plants, according to [12], who said that corn plants lack the nutrient P. It is suspected that other factors influence yield. According to [12], corn production is caused by weeds around the plantation, which can result in differences in the number of rows of seeds per cob. It is suspected that climate change factors occur during prolonged rains, which can potentially disrupt the growth and productivity of corn plants. Biological fertilizer applied around corn plants into the soil is thought to be leached by frequent rainwater; according to [20], corn is a type of plant that cannot tolerate flooding because it disrupts the aeration and plant respiration processes of nutrients in the soil.

5 Conclusions

The interaction between corn plant varieties and liquid biofertilizer on dry land affects plant height and stem diameter. Number of leaves is better for Bisi 99 100 ml, male flowers appear faster at Bisi 99 150 ml, female flowers at Bisi 99 100 ml. Cob location parameters are better for Bisi 99 100 ml. Weight, length, and dry weight of cobs are better for Bisi 99 50 ml. Cob diameter is better for Pertiwi 3 100 ml. Number of cob rows is better for Pertiwi 3 50 ml. Tip filling is better for Pertiwi 3 50 ml, 100 grain weight for Pertiwi 3 150 ml.

Based on the research findings, it is recommended that liquid biofertilizers be tailored to dry land to the specific needs of each corn plant variety. For Bisi 99, using 100 ml of biofertilizer can enhance male flower appearance and cob location parameters, while Pertiwi 3 may benefit more from 50 ml of biofertilizer to improve cob diameter and number of cob rows.

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