

Original Research Article

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## Effect of Biofertilizers and Vermicompost on Pomegranate (*Punica granatum L.*) Cutting

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### ABSTRACT

The present experiment entitled Effects of biofertilizers and vermicompost on rooting of pomegranate (*Punica granatum L.*) cuttings was conducted at nursery, Horticulture Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.), during the period of 2018-19. The present experiment was conducted to study the effect of different biofertilizers, vermicompost and water as control (viz, control, PSB, *Azotobacter*, *Azospirillum*, *Vermicompost* @ 5% of rooting media) with three replication in a complete randomized design (CRD), under shade net condition. The study revealed that significant differences were existed among the treatments for different rooting and shooting parameters. Among the different treatments the earliest sprouting of cutting as well as significantly highest percentage of success, number of leaves per shoot, length of root, diameter of root, fresh weight of roots, and number of roots per cutting were observed in PSB @ 5% rooting media followed by *Azotobacter* @ 5% rooting media. However the performance of cutting in treatment control was inferior.

#### Keywords

Pomegranate, PSB, *Azotobacter*, *Azospirillum*, Vermicompost, *Punica granatum*

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### Introduction

Pomegranate (*Punica granatum L.*) belonging to family Lythraceae, is an ancient fruit originated in Persia, Afghanistan and Baluchistan (De Candolle, 1967). Pomegranate is important crop of India and is said to be native to Iran (Persia) have some special botanical characteristics, the tree have a identical bushy shape having multiple-stems, the bushiness in plant is because of

suckers routinely arising from the base. The plant has an average height of 5-8 m tall. The plant is normally deciduous in nature. The newly arrived shoots are thin and weepy caring thorns. The color of the leaves is dark green with a shiny appearance and the size of the leaves is small with alternate arrangement. The plant is monoecious with two types of conspicuous flowers which arise in the new grown stems in the spring season, major bloom period is the spring season. The

nutritive value of pomegranate fruits is very high and has several health benefits. Pomegranate fruits are rich in vitamin C, potassium and antioxidants. Nutritional value of 100g of edible arils is having 346KJ energy, 18.7 g carbohydrates, 13.7 g sugars, 1.7 g protein, 1.2 g fat, 236 mg potassium, 10 mg vitamin C, 0.07 mg thiamine and 4.0 g dietary fibre. The fruits also have therapeutic values accompanying considerable pharmacological properties like antimicrobial, antiviral and antimutagenic effects (Negi *et al.*, 2003; Seeram *et al.*, 2005).

Pomegranate is propagated by both sexual and asexual means. Rhizogenesis is the most habitually used organogenetic phenomenon in vegetative multiplication of pomegranate. Pomegranates can be propagated using both softwood or hardwood cuttings, but hardwood cuttings are commercially adopted methods. Some biofertilizers play important role in rooting of cuttings, by making the nutrients available to the growing roots. PSB is responsible for increasing the availability of phosphorus to the root zones of the plants. *Azotobacter* and *Azospirillum* helps to increase the uptake of nitrogen and other nutrients by making them available by the plants. nowadays organic pomegranates production requires the cutting which are propagated by utilization of organic natural products, which can be done by using biofertilizers and organic compost.

### **Materials and Methods**

The present investigation was carried out from September 2018 to February 2019 at nursery Horticulture Farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The type of cuttings used was hard wood cuttings of uniform size (15-20 cm long) with 5-6 functional buds were taken from vigorous, healthy plants of pomegranate variety Super

Bhagva. For the preparation of cutting healthy, vigorous, disease free plant of pomegranate variety Super bhagva was selected. The partially matured branches, 0.75-1.00 cm in thickness were taken for cuttings preparation. The cuttings of 15-20 cm in length with 5-6 functional buds were prepared for planting and the leaves removed entirely. Shortly after their preparation, cuttings were kept in water to maintain the amount of moisture until planting time. Whereas, bio fertilizers and vermicompost @ 5% were mixed as per treatment in the rooting medium. Two third parts of the treated cuttings were placed in the rooting media at a slight angle (about 60° ) vertical to the plane. The rooting media was provided water to supply moisture to the cutting and soil around the cutting area was pressed lightly to fix the cutting in rooting media.

### **Results and Discussion**

#### **Days taken to start sprouting of cuttings**

Data presented in table 1 shows that there was a significance difference present between the treatments, for the days taken to start sprouting and the days taken for the initiation of sprouting of cuttings ranged from 8.67 days to 12.00 days. The earliest sprouting of cutting was recorded in PSB @ 5% of rooting media (8.67 days), followed by Vermicompost @ 5% of rooting media (9.33days). Whereas, late sprouting of cuttings (12.00 days) were recorded under control. The result is in accordance with Wahab *et al.*, 1999

#### **Days taken to 50% sprouting of cuttings**

The Data presented in table 1 shows that the days taken to 50% sprouting of cutting ranged from 27.33 to 30.67 days. The minimum days taken to 50% sprouting of cuttings was observed under PSB @ 5% of rooting media

was (27.33 days), followed by *Azotobactor* @ 5% of rooting media (27.67 days). Whereas, maximum days taken to 50% sprouting of cuttings (30.67 days) were recorded under control. PSB causes a significant increase in earliness of sprouting and 50% sprouting of cuttings, (Yadav *et al.*, 2002) in phalsa. It might be due to increase in the level of endogenous auxin by applying PSB.

### **Percentage of success of cuttings**

The data presented in table 1 shows that the percentage of success of cuttings ranged from 66.67 to 76.67 %. The maximum percentage of success of cutting was observed under *PSB* @ 5% of rooting media was (76.67%). Whereas, minimum percentage (66.67%) of success of cuttings was recorded under control. The result is in harmony with *Slankis et al.*, 1973

### **Number of shoots per cutting**

The data presented in the table 2 at 30 DAP shows that the number of shoots per cutting ranged from 3.27 to 4.07. The maximum number of shoots per cutting was observed under *Azotobactor* @ 5% of rooting media (4.07). Whereas, minimum number of shoots per cutting were observed under Control (3.27). At 60 DAP the number of shoots per cutting ranged from 4.20 to 5.07. The maximum number of shoots per cutting was observed under *Azospirillum* @ 5% of rooting media (5.07). Whereas, minimum number of shoots per cutting were observed under Control (4.20). At 90 DAP the number of shoots per cutting ranged from 4.67 to 6.20. The maximum number of shoots per cutting was observed under *PSB* @ 5% of rooting media (6.20). Whereas, minimum number of shoots per cutting were observed under Control (4.67). At 120 DAP the number of shoots per cutting ranged from 5.47 to 7.07. The maximum number of shoots per cutting

was observed under *PSB* @ 5% of rooting media (7.07). Whereas, minimum number of shoots per cutting were observed under Control (5.47). At 150DAP the number of shoots per cutting ranged from 6.00 to 7.67. The maximum number of shoots per cutting was observed under *PSB* @ 5% of rooting media (7.67). Whereas, minimum number of shoots per cutting were observed under Control (6.00). At 180DAP the number of shoots per cutting ranged from 6.80 to 8.27. The maximum number of shoots per cutting was observed under *Azotobactor* @ 5% of rooting media (8.27). Whereas, minimum number of shoots per cutting were observed under Control (6.80).

### **Length of shoots (cm)**

Data presented in the table 3 shows that, at 30 DAP the length of the longest shoots per cutting ranged from 8.41 to 11.44. The maximum length of shoots per cutting was observed under *PSB* @ 5% of rooting media (12.07). Whereas, minimum length of shoots per cutting were observed under Control (8.40). At 60 DAP the length of the longest shoots per cutting ranged from 15.09 to 19.01. The maximum length of shoots per cutting was observed under *PSB* @ 5% of rooting media (19.01). Whereas, minimum length of shoots per cutting were observed under Control (15.09). At 90 DAP the length of the longest shoots per cutting ranged from 20.47 to 21.89. The maximum length of shoots per cutting was observed under *PSB* @ 5% of rooting media (21.89). Whereas, minimum length of shoots per cutting were observed under Control (20.47). At 120 DAP the length of the longest shoots per cutting ranged from 23.25 to 26.44. The maximum length of shoots per cutting was observed under *PSB* @ 5% of rooting media (23.25). Whereas, minimum length of shoots per cutting were observed under Control (26.44). At 150 DAP the length of the longest shoots per cutting

ranged from 25.81 to 29.72. The maximum length of shoots per cutting was observed under PSB @ 5% of rooting media (29.72). Whereas, minimum length of shoots per cutting were observed under Control (25.81). At 180 DAP the length of the longest shoots per cutting ranged from 27.79 to 31.41. The maximum length of shoots per cutting was observed under PSB @ 5% of rooting media (31.44). Whereas, minimum length of shoots per cutting were observed under Control (27.79).

### **Number of leaves per shoot**

Data in table 4 shows that, at 30 DAP the number of leaves per shoots ranged from 8.73 to 10.60. The maximum number of shoots per cutting was observed under PSB @ 5% of rooting media (10.60).Whereas, minimum number of leaves per shoots were observed under Control (8.40). At 60 DAP the number of leaves per shoots ranged from 14.33 to 17.60. The maximum number of shoots per cutting was observed under PSB @ 5% of rooting media (17.60).Whereas, minimum number of leaves per shoots were observed under Control (14.33). At 90 DAP the number of leaves per shoots ranged from 20.27 to 23.60. The maximum number of shoots per cutting was observed under PSB @ 5% of rooting media (23.60).Whereas, minimum number of leaves per shoots were observed under Control (20.27). At 120 DAP the number of leaves per shoots ranged from 24.93 to 27.13. The maximum number of shoots per cutting was observed under PSB @ 5% of rooting media (27.13).Whereas, minimum number of leaves per shoots were observed under Control (14.93). at 150 DAP the number of leaves per shoots ranged from 27.40 to 30.13. The maximum number of shoots per cutting was observed under PSB @ 5% of rooting media (30.13).Whereas, minimum number of leaves per shoots were observed under Control (27.40). At 180 DAP

the number of leaves per shoots ranged from 29.87 to 32.73. The maximum number of shoots per cutting was observed under PSB @ 5% of rooting media (32.73).Whereas, minimum number of leaves per shoots were observed under Control (29.87).The result is in accordance with Hakim *et al.*, 2018.

### **Total number of leaves per cutting**

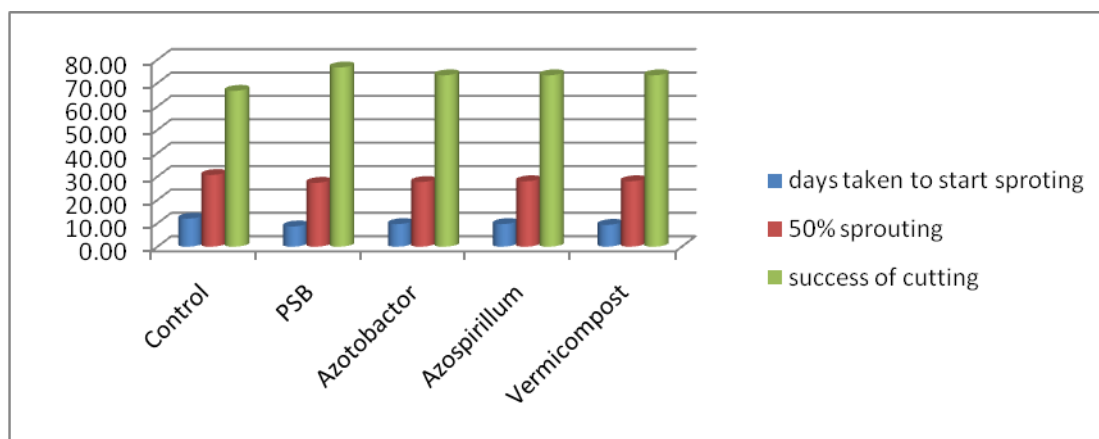
The data in table 5 shows that, at 30DAP the total number of leaves per cutting ranged from 31.40 to 38.00. The maximum number of leaves per cutting was observed under PSB@ 5% of rooting media (38.00). Whereas, minimum number of leaves per cutting were observed under Control (31.40). At 60DAP the total number of leaves per cutting ranged from 65.33 to 73.93. The maximum number of leaves per cutting was observed under PSB@ 5% of rooting media (73.93). Whereas, minimum number of leaves per cutting were observed under Control (65.33). At 90, 120, 150 and 180 DAP the total number of leaves per cuttings ranged from 75.33 to 86.33, 83.60 to 90.40, 86.67 to 95.27 and 89.40 to 97.07 respectively. The maximum number of leaves per cutting was observed PSB @ 5% of rooting media (86.33, 90.40, 95.27 and 97.07).Whereas, minimum number of leaves per cutting were observed under Control (75.33, 83.60, 86.6 and 89.40) respectively.

### **Survival percentage of cuttings**

The data presented in table 6 shows that the survival percentage of cuttings ranged from 56.67 to 70.00 %. The maximum survival percentage of cutting was observed under *Azotobactor and Azospirillum* @ 5% of rooting media (70.00%).Whereas, minimum percentage (56.67%) of success of cuttings was recorded under control. The result is in same line with Sonawane and Konde (1997)

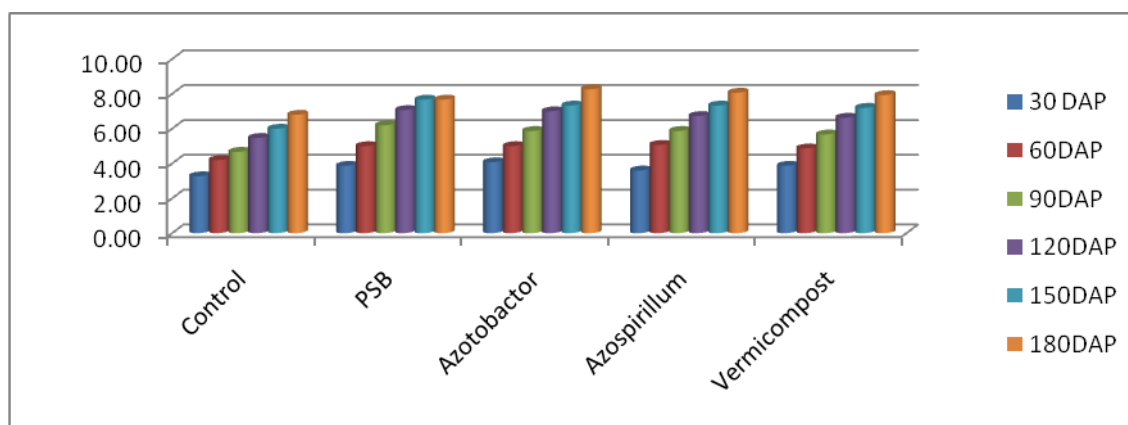
**Table.1** Effect of biofertilizers on days taken to start sprouting, days taken to 50 % sprouting, success percent

Treatment	days taken to start sprouting	50% sprouting	success of cutting
Control	12.00	30.67	66.67
PSB	8.67	27.33	76.67
Azotobactor	9.67	27.67	73.33
Azospirillum	9.67	28.00	73.33
Vermicompost	9.33	28.00	73.33



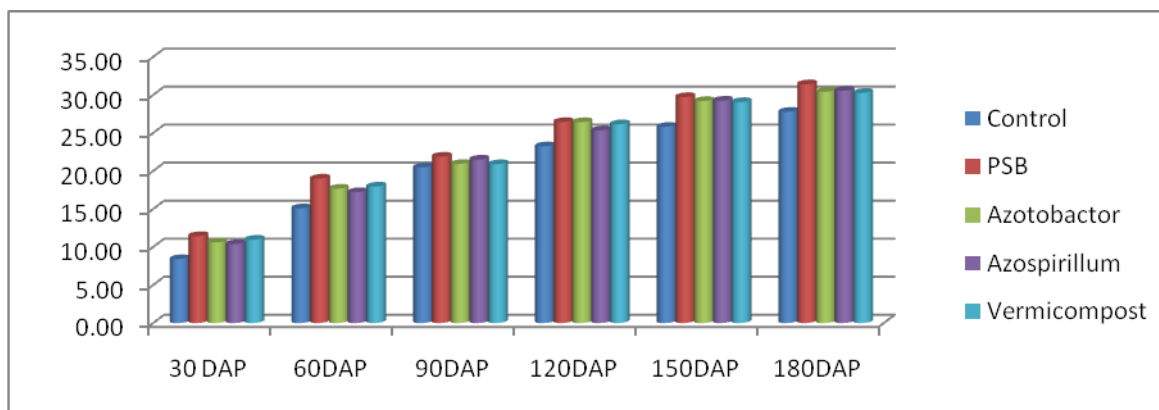
**Table.2** Effect of bio control agents on number of shoots per cutting

Treatment	30 DAP	60DAP	90DAP	120DAP	150DAP	180DAP
Control	3.27	4.20	4.67	5.47	6.00	6.80
PSB	3.87	5.00	6.20	7.07	7.67	7.67
Azotobactor	4.07	5.00	5.87	7.00	7.33	8.27
Azospirillum	3.60	5.07	5.87	6.73	7.33	8.07
Vermicompost	3.87	4.87	5.67	6.63	7.20	7.93



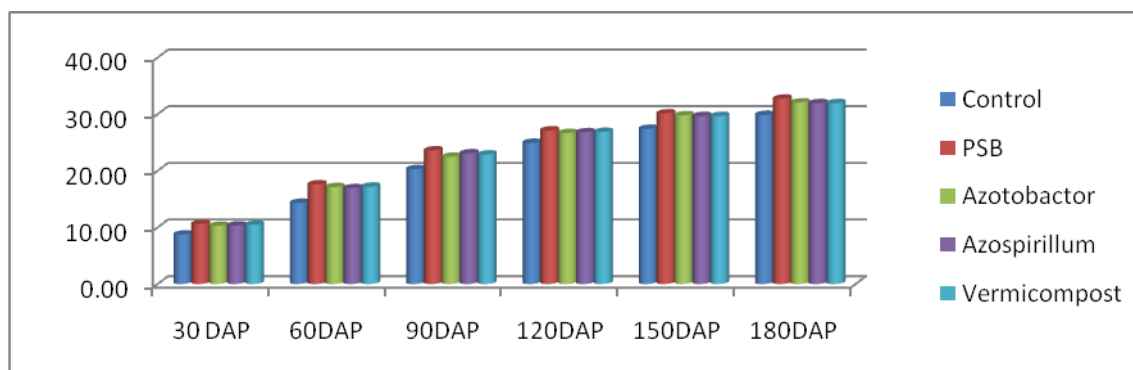
**Table.3** Effect of bio control agent on length of shoots

Treatment	30 DAP	60DAP	90DAP	120DAP	150DAP	180DAP
<b>Control</b>	8.41	15.09	20.47	23.25	25.81	27.79
<b>PSB</b>	11.44	19.01	21.89	26.44	29.72	31.41
<b>Azotobactor</b>	10.61	17.68	20.93	26.43	29.21	30.43
<b>Azospirillum</b>	10.39	17.22	21.51	25.34	29.26	30.57
<b>Vermicompost</b>	10.97	17.96	20.90	26.15	29.07	30.28



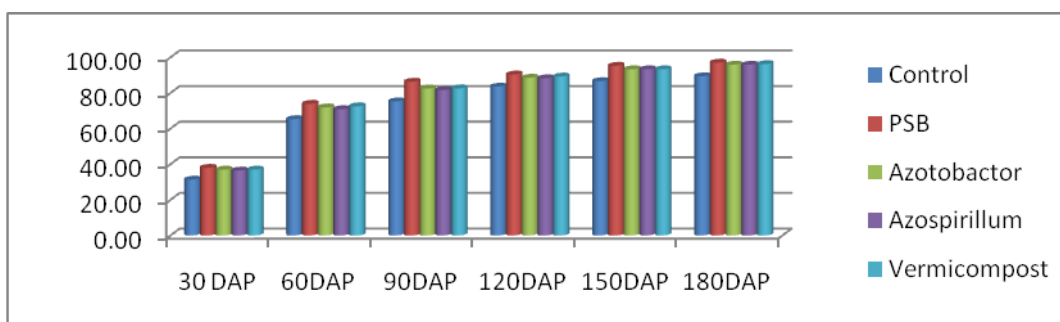
**Table.4** Effect of bio control agent on number of leaves per shoots

Treatment	30 DAP	60DAP	90DAP	120DAP	150DAP	180DAP
<b>Control</b>	8.73	14.33	20.27	24.93	27.40	29.87
<b>PSB</b>	10.60	17.60	23.60	27.13	30.13	32.73
<b>Azotobactor</b>	10.27	17.13	22.47	26.67	29.80	32.07
<b>Azospirillum</b>	10.33	16.93	23.07	26.80	29.67	31.93
<b>Vermicompost</b>	10.47	17.20	22.87	26.87	29.67	31.93



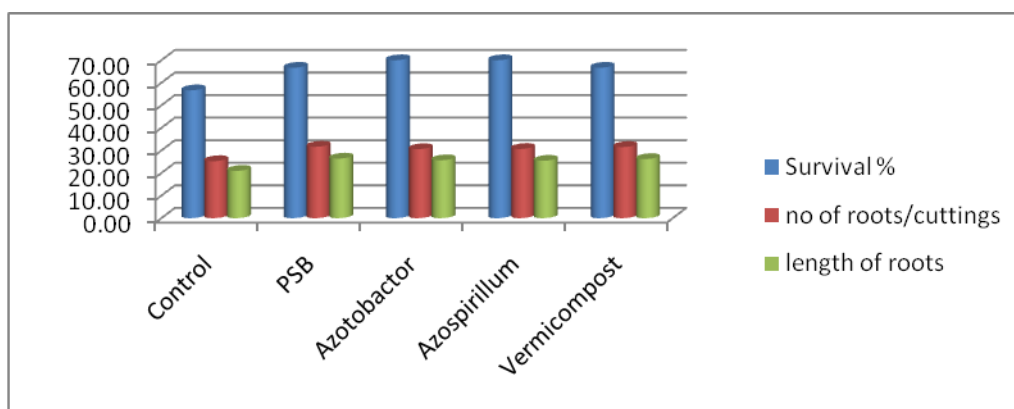
**Table.5** Effect of bio control agent on total number of leaves per cutting

Treatment	30 DAP	60DAP	90DAP	120DAP	150DAP	180DAP
Control	31.40	65.33	75.33	83.60	86.67	89.40
PSB	38.00	73.93	86.33	90.40	95.27	97.07
Azotobactor	37.00	71.93	82.53	88.60	93.33	95.93
Azospirillum	36.47	70.93	81.67	88.27	93.33	95.87
Vermicompost	37.00	72.53	82.60	89.27	93.33	96.20



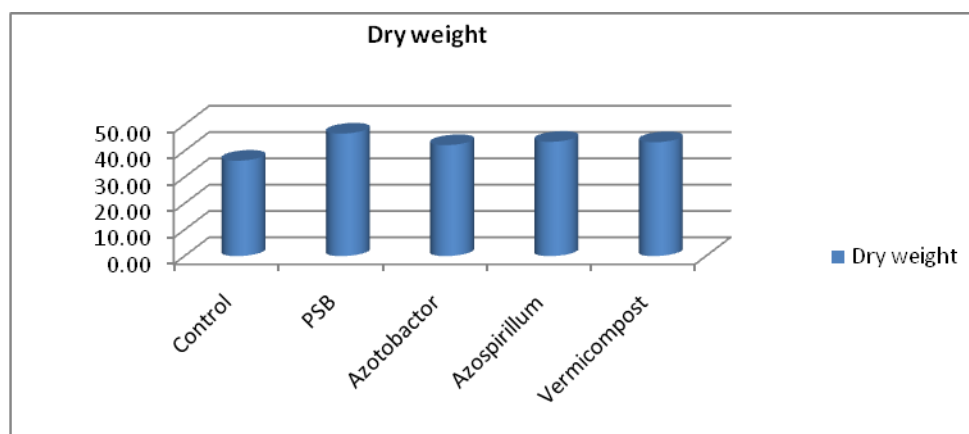
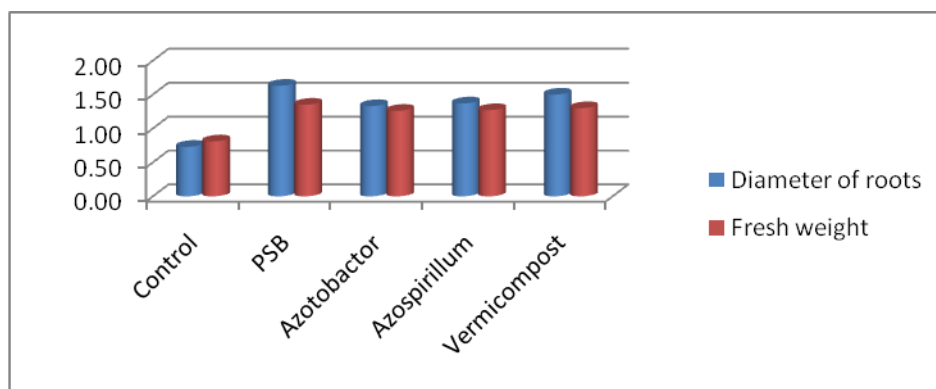
**Table.6** Effect of bio control agent on survival percentage, Number of roots, Length of roots

Treatment	Survival %	no roots/cuttings	of	length of roots
Control	56.67	25.27		20.96
PSB	66.67	31.67		26.39
Azotobactor	70.00	30.60		25.67
Azospirillum	70.00	30.67		25.44
Vermicompost	66.67	31.53		26.19



**Table.7** Effect of bio control agent on Diameter of roots, Fresh weight of roots, Dry matter of roots

Treatment	Diameter of roots	Fresh weight	Dry weight
Control	0.73	0.81	36.30
PSB	1.63	1.35	46.63
Azotobactor	1.33	1.26	42.23
Azospirillum	1.37	1.27	43.50
Vermicompost	1.50	1.30	43.33



### Root characters

#### Number of roots per cutting

The data presented in table 6 shows that the number of roots per cutting ranged from 25.27 to 31.67. The maximum number of roots per cutting was observed under PSB @ 5% of rooting media (31.67). Whereas, minimum percentage (56.67%) of success of cuttings was recorded under control.

#### Length of roots (cm)

The data presented in table 6 shows that the length of roots ranged from 20.96 to 26.39. The maximum length of roots was observed under PSB@ 5% of rooting media (26.39). Whereas, minimum length of roots (20.96) was recorded under control. The result is in same line with Nageswari *et al.*, (1999).



### **Diameter of roots (mm)**

The data presented in table 7 shows that the diameter of roots ranged from to 0.73 to 1.63. The maximum diameter of roots was observed under PSB@ 5% of rooting media (1.63). Whereas, minimum diameter of roots (0.73) was recorded under control.

### **Fresh weight of roots (g)**

The data presented in table 7 shows that the fresh weight of roots ranged from to 0.81 to 1.35. The maximum fresh weight of roots was observed under PSB@ 5% of rooting media (1.35). Whereas, minimum fresh weight of roots (0.81) was recorded under control. The result is in same line with Baqual *et al.*, (2015).

### **Dry matter of roots (%)**

The data presented in table 7 shows that the dry matter of roots ranged from to 36.30% to 46.63%. The maximum length of roots was observed under PSB@ 5% of rooting media (46.63%). Whereas, minimum dry matter roots (36.30%) was recorded under control.

In conclusion, it was observed that use of various dose of biofertilizers resulted in better root and shoot development of pomegranate hardwood stem cutting in consideration with control.

Among the biofertilizers used first sprouting of cutting, sprouting of 50 % of cuttings, highest success percent, root length, leaf count per longest shoot, fresh root weight, root diameter, dry matter content of root and root count per cutting was found to be maximum with application of PSB but survival percentage of cutting was highest with application of Azotobacter and Azospirillum.

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