RESEARCH ON THE EFFECTS OF ORGANIC MICROBIAL FERTILIZERS ON THE GROWTH, DEVELOPMENT AND PRODUCTIVITY OF FALLOPIA MULTIFLORA (THUNB)

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ABSTRACT

The study aimed to determine the effects of some types of organic microbial fertilizers on the growth, development and productivity of Fallopia multiflora. The results of the study showed that: All 3 types of fertilizers used in the experiment had no negative impact on the survival rate of Fallopia multiflora grown at the Center for Experimental Practice and Transfer of Science and Technology. The organic microbial fertilizer Dau Trau MKN.8 (formula 3) had the best impact on Fallopia multiflora in terms of the growth of the main stem length, the number of primary and secondary branches and the factors that constitute the productivity. In terms of pests and diseases, they only appeared at very low and rare levels. 2 types of fertilizers in the formula 2 and formula 4 the data are equivalent to the control, the ± difference compared to the control is insignificant. In which Song Gianh organic fertilizer has the best effect in limiting the appearance of pests and diseases.

NGHIÊN CỨU ẢNH HƯỞNG CỦA PHÂN BÓN HỮU CƠ VI SINH ĐẾN SINH TRƯỞNG, PHÁT TRIỂN VÀ NĂNG SUẤT CỦA HÀ THỦ Ô ĐỎ (FALLOPIA MULTIFLORA (THUNB.))

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TÓM TẮT

Nghiên cứu nhằm xác định ảnh hưởng của một số loại phân bón hữu cơ vi sinh đến sinh trưởng, phát triển và năng suất của cây Hà thủ ô đỏ (Fallopia multiflora). Kết quả cho thấy cả ba

TỪ KHOÁ

Hà thủ ô đỏ (Fallopia multiflora);
Phân bón hữu cơ vi sinh;

loại phân bón sử dụng trong thí nghiệm không gây ảnh hưởng bất lợi đến tỷ lệ sống của cây trồng tại Trung tâm Thực nghiệm, Thực hành và Chuyển giao Khoa học và Công nghệ. Phân hữu cơ vi sinh Đầu Trâu MKN.8 (công thức 3) cho ảnh hưởng tốt nhất đến chiều dài thân chính, số cành cấp 1, cành cấp 2 và các yếu tố cấu thành năng suất. Sâu, bệnh chỉ xuất hiện ở mức rất thấp và không thường xuyên. Kết quả của công thức 2 và công thức 4 nhìn chung tương đương đối chứng, chênh lệch không đáng kể. Trong đó, phân hữu cơ Sông Gianh có tác dụng tốt nhất trong việc hạn chế sự xuất hiện của sâu, bệnh

1. INTRODUCTION

In Vietnam, along with the development of modern medicine, the treatment of diseases by traditional medicine has been widely applied and achieved many important achievements. [1] The demand for using natural ingredients for medicine is increasing. [2] However, natural medicinal resources are increasingly depleted as many species are facing the risk of extinction [3], natural medicinal resources are shrinking or imbalanced spontaneous medicinal farming. Medicinal reserves are decreasing due to rampant exploitation with no plan to preserve medicinal resources. [4]

Tuyen Quang is a mountainous province in the North with 70% of the land area being hills and mountains, the terrain features include many high mountains, especially at an altitude of 800m or more, mainly distributed in the districts of Chiem Hoa, Na Hang, Lam Binh. Due to the influence of terrain, the climate in areas with an altitude of 800m has a subtropical, hot, humid climate, the average annual temperature is 22°, air humidity is about 85%, average rainfall is 1,800mm. With the characteristics of a subtropical climate, Tuyen Quang is a province with great potential for developing medicinal plant cultivation. [5]

According to the report of the Provincial Statistics Department in 2019, the whole province currently has nearly 130 hectares of medicinal plant cultivation with 14 main species: Buddha's hand, polyscias fruticosa, cinnamon, turmeric, black galangal, Solanum procumbens, fallopia multiflora... [6] The potential of medicinal plant resources in some highland communes is quite rich and diverse, but research on fertilizers, conservation, propagation... is still quite limited and incomplete while this special plant species has strict requirements on cultivation techniques. Based on the above practical needs, in order to preserve and develop sustainably with high productivity and good quality of medicinal plant resources, and to care for and develop medicinal plants into commodities, contributing to poverty reduction for people in remote areas, we conducted the topic: "Research on the effects of organic microbial fertilizers on the growth, development, and yield components of Fallopia multiflora (Thunb) at the Center for Experimental Practice and Transfer of Science and Technology, Tan Trao University." [7]

2. Research subjects, contents and methods

2.1. Research subjects: Organic microbial fertilizers affect the growth, development; resistance to some pests and diseases of Fallopia multiflora (Thunb).

2.2. Scale: Fallopia multiflora model with an area of 720 m².

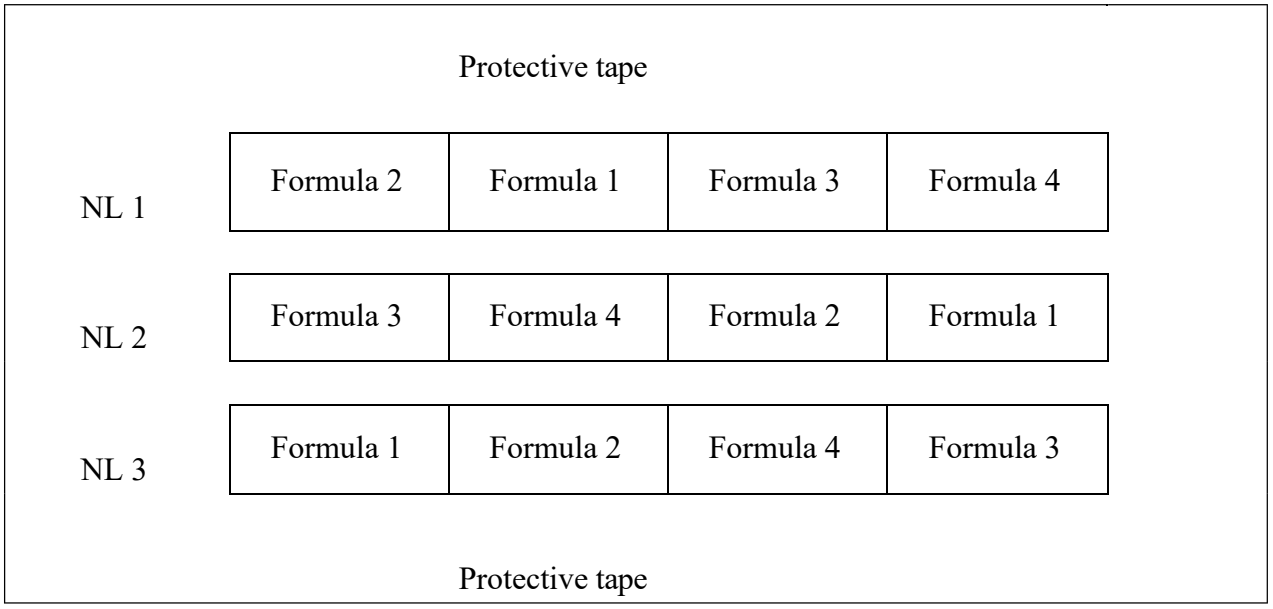

Figure 1. Experimental diagram

2.3. Research contents:

Content 1: Evaluation of growth and development stages, disease resistance of fallopia multiflora.

Content 2: Evaluation of factors contributing to the yield of second-year root tubers of fallopia multiflora.

2.4. Materials and Methods

2.4.1. Land selection

- Land must be far from industrial zones, hospitals, livestock grazing areas, and national highways. Land must not be polluted by agents harmful to human health, and must have a clean history of at least 3 years before. Land must be high, well-drained, such as sandy soil, light loam, loose soil with a thick arable layer, and convenient irrigation.

- Choose light loam, sandy loam, alluvial soil, pH 6 - 6.8, total humus 1.5% in places with active irrigation, far from industrial zones, hospitals, cemeteries, far from wastewater and waste sources, at least 100m from national highways, and no livestock or poultry frequently entering.

2.4.2. Evaluation of growth, development and resistance to pests and diseases

* Experimental setup method:

The experiment was arranged in a complete randomized block, including 4 formulas with 3 replications. The area of 1 plot is 30 m^2. The distance between replications is 0.5 m. Row to row is 70 cm, plant to plant is 50 cm (density 28,000 plants/ha), 1 Polygonum multiflorum plant is planted in a hole. Around the experiment there is a protective strip, the

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width of the strip is at least 2 rows of fallopia multiflora. The total area of the experimental layout is 720 m^2.

* Experimental formulas:

+ Formula 1: Decomposed manure (control)

+ Formula 2: Song Gianh organic fertilizer: 5,000 kg/ha/year

+ Formula 3: Dau Trau MKN.8 organic fertilizer: 5,000 kg/ha/year

+ Formula 4: Organic fertilizer: 5,000 kg/ha/year.

(*Note:* - Song Gianh organic microbial fertilizer (produced by Song Gianh Company): Humidity: 30%; Organic 15%; Effective P2O5: 15%, Humic Acid: 2.5%. Medium: Ca: 1%; Mg: 0.5%; S: 0.3%; Useful microbial strains Bacillus 1 x 106 CFU/g; Azotobacter: 1 x 106 CFU/g; Aspergillus sp: 1 x 106 CFU/g.

- Dau Trau MKN.8 organic microbial fertilizer (produced by Binh Dien Joint Stock Company): Black in color, strong smell, powder form. Applicable published standards (Ingredients, content): Humidity 30%; Organic 20%; Total N 0.6%; P2O5: 1%; Humic Acid: 0.1%; Trichoderma 1 x 106 CFU/g.

- FUSA - GAP organic fertilizer (produced by FUSA Fertilizer Joint Stock Company), Organic matter 25%, C/N ratio: 12, pH: 5, Humidity 30%.)

* The growth and development ability of the Fallopia multiflora plant is evaluated based on the following criteria:

+ Survival rate: Evaluate the survival rate once after 10 days of planting

$$\text{Survival rate (\%)} = \frac{\sum \text{number of surviving plants}}{\sum \text{number of plants planted}} \times 100$$

+ Main stem length (cm): Determined by the height of the plant from the ground to the growing tip of the main stem; every 30 days.

+ Number of level 1,2 branches (branches): Counted all level 1,2 branches on the plant; every 30 days.

- Monitoring method: monitored 5 points on the experiment subjects according to the diagonal rule to evaluate the indicators; each experimental plot selected 5 plants. The total number of plants monitored for each formula is 15 plants.

* The pest resistant ability of the Fallopia multiflora is evaluated based on the following criteria:

Conduct an investigation, determine the components of harmful pests and diseases, the characteristics of the damage caused by some major pests and diseases on the Fallopia multiflora.

+ Monitored pests and diseases based on the National Technical Regulation QCVN 01-38/2010/BNNPTNT on methods of investigating and detecting plant pests [8]. Monitored pests and diseases directly in the field, make a list of pests and diseases and the levels of evaluation:

+: Very few (< 20% of the number of encounters);

++: Few (20 - 40% of the number of encounters);

+++: Average (41 - 60% of encounters);

++++: Many (> 60% of encounters)

- Experimental conditions: The experiment was arranged on high ground with convenient drainage and irrigation.

* Technical measures: Applying the technical instructions for planting and caring for Fallopia multiflora plants of the Center for Research and Application of Science Technology in Agriculture and Forestry, Thai Nguyen University of Agriculture and Forestry. [9]

* Data processing method: Experimental data was statistically processed on Excel software

2.4.3. Evaluation of the second-year root tuber yield of Fallopia multiflora

+ Tuber diameter (cm): Measured at the position with the largest diameter in the middle of the tuber using a palme ruler.

+ Tuber length (cm): Measured from the top to the bottom of the tuber using a hard ruler to divide the length.

+ Number of tubers/root (tubers): counted the number of tubers of 10 consecutive roots and divided the average.

+ Average tuber weight (grams): weighed 10 tubers for 3 repetitions and divided the average. Used an electronic scale with an accuracy of up to gram.

+ Theoretical yield (Quintals/ha): Theoretical yield (Quintals/ha) = [Average tuber weight (g)/plant x number of plants/ha (plants)].

+ Actual yield (Quintals/ha). Weighed all the tubers in the experimental plot. Calculated at harvest time. Then converted to tons/ha.

3. Research results and discussion

3.1. Research results on growth, development and resistance to pests and diseases

3.1.1. Research results on growth and development

To evaluate the influence of the types of fertilizers used as basal fertilizer in the experiment on the survival rate of Fallopia multiflora, the research team monitored the number of living plants 10 days after planting for Fallopia multiflora. The results of monitoring and research are presented in Table 01, as follows:

Table 1. Survival rate of plants 10 days after planting

No.	Formulas	Number of plants planted (plants)	Number of plants alive after 10 days of planting	Percentage of plants surviving 10 days after planting
1	Composted manure (d/c)	500	472	94.4%
2	Song Gianh organic fertilizer	500	472	94.4%
3	Dau Trau MKN.8 organic fertilizer	500	474	94.8%
4	FUSA - GAP organic fertilizer	500	475	95%

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The monitoring results in Table 01 show that: In all 3 experimental formulas, the survival rate of plants after 10 days of planting is very high, the rate reaches from 94.4% to 95%, which is similar to the control (94.4%). Thus, for the Fallopia multiflora plant, all 3 types of fertilizers including: Song Gianh organic microbial fertilizer, Dau Trau MKN.8 organic microbial fertilizer, FUSA - GAP organic microbial fertilizer used as basal fertilizer in the experiment did not affect the survival rate of plants after 10 days of planting. After 10 days of planting, the Fallopia multiflora plants in all formulas had taken root, were green, fresh, and free of pests and diseases.

Table 2. Effects of fertilizers on the growth dynamics of the main stem height of the Fallopia multiflora plant after 10 months of planting

No.	Days after planting (days)	Unit	Formula 1 (D/c)	Formula 2	Formula 3	Formula 4
1	30	cm	24.4	26.2	26.6	24.2
2	60	cm	45.2	43.3	46.9	43.7
3	90	cm	85.3	90.1	87.1	84.3
4	120	cm	121.3	125.5	125.5	124.1
5	150	cm	195.3	212.5	207.9	197
6	180	cm	231.1	242.9	251.0	230.1
7	210	cm	304.3	298.1	322.6	306.6
8	240	cm	320.5	315.3	337.7	320.1
9	270	cm	331.2	325.7	343.0	331.3
10	300	cm	336.3	333.5	350.4	338.6

The results of Table 02 show that: The impact of fertilizers in the experiment on the growth of the main stem length of the Polygonum multiflorum plant is different. Specifically:

Impact of Song Gianh organic microbial fertilizer (formula 2): At 30 days after planting, the main stem length of the Polygonum multiflorum plant is 26.2cm, 2.2cm higher than the control; at 60 days after planting, it is 43.3cm, 1.9cm lower than the control; from 90 to 180 days, the main stem length is always 4.2cm to 11.8cm higher than the control. From 210 to 300 days after planting, the main stem length of the plant is always 3.2cm to 6.2cm lower than the control. Thus, for this type of fertilizer, the most obvious and best impact is from 90 to 180 days after planting. The effect of this fertilizer on the growth of the main stem length of

polygonum multiflorum from post-planting to 300 days was lower than that of the control, but the difference was not significant.

The impact of Dau Trau MKN.8 (formula 3) organic microbial fertilizer on the growth of the main stem length of Polygonum multiflorum from planting to the monitoring time of 300 days after planting was higher than the control. and was the fertilizer with the most stable and best impact among the 3 experimental formulas. The impact in 300 days from planting of this fertilizer on the growth of the main stem length of Polygonum multiflorum was significantly higher than the control.

The impact of FUSA - GAP organic fertilizer (formula 4) on the growth of the main stem length of the Polygonum multiflorum plant is basically equivalent to the control formula. At all monitoring times, the data are equal or different from ± 1cm to 2cm compared to the control. The impact from post-planting to 300 of this fertilizer on the growth of the main stem length of the Polygonum multiflorum plant is higher than the control. However, the difference is not significant.

The monitoring data also shows that: the growth rate of the main stem length of the Polygonum multiflorum in all 3 formulas is highest at the stage of 120 - 210 days after planting. Considering the average growth stages of the main stem height of the Polygonum multiflorum, formula 3 gives the highest value, higher than the control formula. From 210 days to 300 days after planting, the main stem length of the Polygonum multiflorum in the formulas grows more slowly than in the previous stages. From 210 days after planting, the main stem length of the plant has reached nearly the maximum threshold, only growing strongly in the length of the first and second level branches. Thus, the height growth rate of the Polygonum multiflorum is reduced, the amount of matter produced by the photosynthesis process tends to accumulate nutrients in the tubers. Therefore, there are many products accumulated in the tubers, leading to high yield potential.

For climbing plants such as Polygonum multiflorum, the number of leaves on the tree depends on the number of level 1. 2.… branches on the tree. This is the basic indicator to create the productivity of the tree. Because the number of level 1.2 branches on the tree is determined to be the most important for the tree and the number of level 3. 4… branches is very large. Therefore, the topic only monitors the branching dynamics of level 1 and level 2 branches on the Polygonum multiflorum. The monitoring results are shown in Table 3 as follows.

Table 3. Effects of fertilizers on the growth dynamics of level 1 branches on the Polygonum multiflorum

No.	Days after planting	Unit	Formula 1 (Control)	Formula 2	Formula 3	Formula 4
1	**30**	Stems	3.21	3.3	3.3	3.21
2	**60**	Stems	5.0	5.2	5.2	5.0
3	**90**	Stems	6.0	6.23	6.13	6.03

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4	**120**	Stems	7.23	7.03	7.53	7.33
5	**150**	Stems	8.3	8.53	9.03	8.33
6	**180**	Stems	9.0	9.20	9.33	8.96
7	**210**	Stems	8.60	8.23	8.66	8.56
8	**240**	Stems	7.6	6.73	7.26	7.73
9	**270**	Stems	7.2	6.33	7	7.33
10	**300**	Stems	6.4	5.53	6.06	6.46

From the data presented in Table 03, it can be seen that: In all 3 experimental formulas, from 30 to 180 days after planting, the growth rate of the number of level 1 branches always increases and the fastest growth rate is from 30 to 60 days after planting (average growth of 2 branches). In the period from 90 to 180 days after planting, the average growth rate per monitoring period is 1 branch. From 210 to 300 days after planting, the growth rate of the number of level 1 branches gradually decreases, on average 1 branch per monitoring period, in which, formula 2 has the strongest decrease, approximately 2 branches.

Table 4. Effects of fertilizers on growth dynamics of level 2 branches on Polygonum multiflorum

No.	Days after planting	Unit	Formula 1 (Control)	Formula 2	Formula 3	Formula 4
1	**30**	Stems	5.33	5.66	5.66	5.33
2	**60**	Stems	7.3	7.66	7.66	7.33
3	**90**	Stems	9.33	9.6	9.33	9.4
4	**120**	Stems	10.46	10.13	10.73	10.53
5	**150**	Stems	11.66	11.8	11.06	11.66
6	**180**	Stems	12	12.26	12.33	12.93
7	**210**	Stems	10.73	10.13	10.66	10.53
8	**240**	Stems	9.6	9.53	9.26	9.73
9	**270**	Stems	8.2	7.33	8.0	8.33
10	**300**	Stems	7.3	6.66	7.0	7.33

From the data presented in Table 04, it can be seen that: The growth dynamics of level 2 branches in all 3 experimental formulas are similar to the growth dynamics of level 1 branches.

In the first stage after planting, from 30 days to 90 days, the growth of the number of level 2 branches is 2 branches/monitoring period

In the later stage, from 90 days to 180 days, the growth of the number of level 2 branches is 1 branch/monitoring period.

In the stage from 180 to 300 days, the number of level 2 branches decreases by 0.1 branch/monitoring period. In which, formula 2 has the fastest and strongest decrease compared to the control formula.

Thus, we can conclude that all 3 types of fertilizers in the experiment have an impact on the growth of level 1 and level 2 branches on the Polygonum multiflorum plant according to the following rule: On average, from 30 to 90 days after planting, the growth rate is 2 branches/month and from 90-180 days it is 1 branch/month. After that, the growth rate decreases to an average of 1 branch/month.

3.2. Pest resistance of Fallopia multiflora

To effectively prevent pests and diseases on crops in general and on Polygonum multiflorum in particular, we need to identify the main pests, the location of the damage and the time of damage, so we have monitored the above indicators, the monitoring results are presented in Table 05 as follows:

Table 5. Time of pest infection and their location of damage to Polygonum multiflorum

No.	Causes of damage	Locations of damage	Time of damage/infection
1(Control)	Cricket	Roots, tubers and leaves	All stages of plant growth
2	Black cutworm	Leaves	Young buds and young leaves
3	Aphids	Leaves	From 120 days old stage
4	Damping Off	Root	Early stage when newly planted (From after planting to less than 30 days)

Through table 05, it shows that:

There are 3 types of pests and 01 main disease on Polygonum multiflorum grown at the Center for Experimental Practice and Technology Transfer, Tan Trao University: Cricket, Black cutworm, Aphids, Damping Off. In which:

The location of damage of all 3 pests is on the leaves of the plant, only Crickets damage both the roots and tubers of the plant.

About the time of damage:

- Crickets cause damage at all stages of plant growth, so to effectively prevent them, we apply chemicals and baits as soon as we detect crickets at an economically damaging level.

- Black cutworms cause severe damage to young shoots and young leaves

- Aphids only appear and cause damage from stage 120 after planting, at this time the trellis is green and lush, covering the trellis, with leaf density.

- Damping Off, causing damage from the early stages of planting to 30 days after planting.

Thus, it can be seen that crickets cause damage to Polygonum multiflorum at all ages, crickets gnaw the roots, tubers and leaves of the plant. Crickets often dig holes under the roots of Polygonum multiflorum and gnaw the tubers underground or drag leaves into the holes.

Black cutworms cause damage to Polygonum multiflorum at the larval stage, this species often eats leaves or bites off the stem, however, in experimental conditions, the phenomenon of Black cutworms biting off the stem has not been detected, but only caused damage to the leaves and the base of the plant. The time of damage is often at night, so it is very difficult to detect, we could only search for pests from the bite marks on the leaves.

Aphids appear on Polygonum multiflorum from the 120-day old stage, causing damage to the leaves, aphids gather in swarms under the leaf surface and suck nutrients, causing the leaves to wither and dry.

Damping Off appeared in the early stages when the plants were newly planted in the ground, causing the death of some plants, but the rate was not high. Later, traces of Damping Off were still recorded in the experimental plot, but the rate was not large and did not harm the experimental plants.

Effect of organic microbial fertilizers on the rate of pest infection of Polygonum multiflorum

The majority of pests and diseases on the Polygonum multiflorum plants in the fertilizer experiment were at a low level, recorded from 10 - 25% of the plants with pests and diseases out of the total number of plants monitored. It can be seen that crickets and damping off caused the most damage to the formulas in the fertilizer experiment, due to their omnivorous nature, this species is easy to cause damage, however, the severity is not very large, only affecting the appearance of the Polygonum multiflorum tubers.

The damping off disease occurred in the early planting stage, when the plants were still very weak, leading to the death of some seedlings. Later, the disease occurred due to prolonged rainy and humid conditions, but at this stage the plants were already strong, so the impact was less, although it did not cause death, it made some plants grow slower than others.

The monitoring results in Table 06 show that:

Different types of fertilizers have an impact on the infection rate of major pests and diseases on Polygonum multiflorum at different levels, specifically: Formula 2 using Song Gianh organic microbial fertilizer has a lower infection rate of pests and diseases than the control formula across all major causes of damage and has the lowest infection level among the 3 experimental formulas, followed by formula 3 and formula 4.

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Table 6. Effect of microbial fertilizers on the rate of pest and disease infection of Polygonum multiflorum

Formula	Crickets (points)	Black Cutworms (points)	Aphids (points)	Damping Off (points)
1 (Control)	++	++	+++	+++
2	+	+	+	++
3	+	++	++	+
4	++	++	++	++

3.3. Evaluation of second-year root tuber yield

Crop yield is an important indicator reflecting the results of the growth, development, assimilation and accumulation of nutrients of crops in general and Polygonum multiflorum in particular. Crop yield is influenced by many factors, from internal factors to external factors. For Polygonum multiflorum as well as other crops, when grown on good soil, with proper care techniques and suitable external conditions, the plants will grow well and produce high yield and quality.

To evaluate the impact of the 3 types of fertilizers used in the experiment on the yield components, we monitored the effects of the experimental formulas on the yield components of Polygonum multiflorum, the results are shown in Table 07 as follows:

Table 7. Factors contributing to yield and productivity of second-year Polygonum multiflorum tubers

Formula	Number of tubers/root (tubers)	Length of tuber (cm)	Diameter of tuber (cm)	Average weight of tuber (gram)	Theoretical yield quintals/ha	Actual yield quintals/ha
1 Control	3.33	21.50	2.66	793	73.95	62.84
2	4.13	27.13	2.93	805	93.09	79.50
3	4.66	29.16	3.00	815	106.34	87.30
4	3.13	27.66	2.7	797	69.85	60.20

Note: Tuber yield after 18 months of planting

The data in Table 07 shows that:

Regarding the number of tubers/root: formula 3 has an average of 4.66 tubers/root, which is the formula with the highest number of tubers and higher than the control, formula 4 has 3.13 tubers/root, which is the formula with the lowest number of tubers and is lower than the control (3.33 tubers/root).

Regarding tuber length: The control formula is the lowest at 21.5cm, all 3 experimental formulas have higher results than the control, reaching from 27.13cm to 29.16cm, in which formula 3 is the formula with the highest, 7.54cm higher than the control. Compared with the research results of other authors, the tuber length of the control formula and all 3 formulas are lower, the reason is that the experimental time was shortened by 04 months, the total time from planting to harvest is only 20 months, and the final stage is the stage of strong biomass increase of the tuber (planting time February 2022, harvest time October 2023).

Regarding tuber diameter: The control formula is the formula with the lowest tuber diameter of 2.66cm, all 3 experimental formulas are higher than the control formula, in which formula 3 is the formula with the highest, higher than the control at 3.0cm, followed by formula 2 at 2.93 cm and formula 4 at 2.70 cm.

Regarding the average weight of the tuber, it ranges from 793g to 815g, in which: Formula 3 yielded the largest tuber weight, followed by Formula 2, Formula 4 yielded the lowest, which is the control formula.

Regarding theoretical yield: Formula 3 achieved the highest theoretical yield of 106.34 quintals/ha and was 32.39 quintals/ha higher than the control, 13.25 quintals/ha higher than formula 2, and 36.49 quintals/ha higher than formula 4.

Regarding actual yield: Formula 3 achieved the highest actual yield of 87.30 quintals/ha and was 24.46 quintals/ha higher than the control, 7.80 quintals/ha higher than formula 2, and 27.10 quintals/ha higher than formula 4.

Thus, it can be seen that:

Different types of fertilizers have different impacts on the factors that make up the yield of Polygonum multiflorum, in which formula 3 using Dau Trau MKN.8 organic fertilizer gave the highest efficiency, followed by Song Gianh organic fertilizer and FUSA - GAP organic fertilizer.

The theoretical and actual yields of all four formulas in this study were 60.2 quintals/ha - 87.30 quintals/ha, lower than the average yield published in other studies and reports (the average yield of Polygonum multiflorum tubers in the second year is usually from 80 quintals/ha - 100 quintals/ha). The reason is due to objective reasons that the tubers must be harvested 18 months after planting, at which time the tubers have not yet reached their maximum growth in weight.

4. Conclusion

- All 3 types of fertilizers used in the experiment did not have a negative impact on the survival rate of Polygonum multiflorum plants grown at the Center for Experimental Practice and Technology Transfer.

- Dau Trau MKN.8 (formula 3) microbial organic fertilizer had the best impact on Polygonum multiflorum plants in terms of the growth of the main stem length, the number of primary and secondary branches, and the factors that constitute the yield and productivity. In terms of pests and diseases, they only appeared at a very low level and did not affect the growth of the plants.

- The data of the 2 types of fertilizers in formula 2 and formula 4 were equivalent to the control, the difference ± compared to the control was insignificant. However, in terms of pests

and diseases and productivity, Song Gianh organic fertilizer was superior, especially in terms of pests and diseases appearing at a very low level, in general, formula 2 had the best effect in limiting the occurrence of pests and diseases.

REFERENCES

1. Vietnam Health of Ministry (2009). Vietnam Pharmacopoeia IV. *Medical Publishing House*, Hanoi, pp. 772-773.

2. Bich Do Huy (2006). Medicinal plants and medicinal animals in Vietnam. Volume 1. *Science and Technology Publishing House*, Hanoi, pp 884-888.

3. Loi Do Tat (2014). Vietnamese medicinal plants and herbs. *Medical Publishing House*, Hanoi.

4. Ban Nguyen Tien et. al. (2007 Vietnam Red Book, part II - Plants. *Science and Technology Publishing House*, Hanoi.

5. Quang Ninh and the goal of developing into a major medicinal center of Vietnam. https://www.quangninh.gov.vn/pinchitiet.aspx?nid=59780.

6. Yen Bai: Developing medicinal plants, increasing people's income. https://www.yenbai.gov.vn/giam-ngheo/noidung/tintuc/Pages/chi-tiet-tin-tuc.aspx?ItemID=1195&l=TinHoatDong.

7. The Council evaluates and inspects the results of the project: Research and application of scientific and technological advances in cultivating Polygonum Multiflorum (Fallopia multiflora (Thumb.) Haraldson.) in ethnic minority areas of Dak Lak province. https://daklak.gov.vn/kh-cn/-/asset_publisher/q4G3GTaowEXM/content/hoi-ong-anh-gia-nghiem-thu-ket-qua-e-tai-nghien-cuu-ung-dung-tien-bo-khcn-trong-trong-trot-ha-thu-o-o-polygonum-multiflorum-thumb-haraldson-tai-vung-o/pop_up?_101_INSTANCE_q4G3GTaowEXM_viewMode=print.

8. National Technical Regulation QCVN 01-38:2010/BNNPTNT on methods for investigation and detection of plant pests.

9. National Institute of Medicinal Materials (2005). Techniques for growing, using and processing medicinal plants, *Agriculture Publishing House*, Hanoi.