IMPACTS OF WATERING METHOD AND FREQUENCY ON SEVERAL BIOPHYSICS CHARACTERISTICS AND PRODUCTIVITY OF WAXY MAIZE (*ZEA MAYS L.*)

Nhan Pham Ngoc, Tin Huynh Quang, Huy Le Duc, Liem Le Tran Thanh

Can Tho University, Vietnam

Abstract

Cultivation technique is one of the important factors that helps improve plant productivity. Of which, using proper watering method can not only help plants grow faster but also help reduce water usage in the context of severe weather conditions that lead to water shortage for irrigation in agriculture. The research was conducted on rice land during Spring-Summer season in Chau Thanh A district, Hau Giang province and it aims at finding out suitable watering methods and frequency for maize (Zea mays L.) cultivation. The research includes 2 factors with 4 formal solutions with 4-time repetition. According to test results, plant height in A2B1 formal solution (method of bottom watering, once a day) is the highest one. Also, watering once a day makes the growing speed achieve the fastest one. Corncob weight and diameter, weight of 1000 kernels, productivity in theory and in reality of A1B2 (formal solution of sprinkler watering, once every 3 days) are the highest. Based on physiological maturity observation, A1B2 (formal solution of sprinkler watering, once every 3 days) and A2B2 (formal solution of bottom watering, once every 3 days) have the shortest physiological maturity. According to calculation of efficiency on the tested crops, investment cost is 1.044,22 USD while the profit is 857,13. It is also found out that using sprinkler watering once every 3 days can help maize crops in Spring-Summer season achieve higher productivity in Hau Giang province.

Keywords: *maize, watering frequency, watering method, productivity, growth*

1. INTRODUCTION

Maize *(Zea mays L.)* is the third most important food crop globally after wheat and rice in terms of production areas and ranked first in terms of productivity and yield (FAO, 1995). Also, maize has made great contributions to agricultural development and to maintaining food security in the world. In the context of crop composition conversion supported by the Government, maize is one of the crops that can prove its efficiency for farmers who converted their crop composition from 3 rice crops a year into 2 rice crops – 1 maize crop a year. Waxy maize can grow well on land where rice has become less productive in the Mekong Delta. This is the reason why the composition of 2 rice crops – 1 maize crop has been encouraged to be applied by local authorities. According to data from General Statistics Bureau (2017), in the process of crop composition conversion in Hau Giang province, the areas growing maize has kept expanding year after year from 2,190 hectares in 2012 to 3,200 hectares in 2016 (an increase of 1,100 hectares). For Spring-Summer season, as agriculture production in the province has to face the shortage of water for irrigation, a number of farming households have converted towards drought-tolerant crops and of which maize is a suitable choice with high productivity. In order to increase maize's productivity to meet domestic demand then reduce corn for overseas import, research on new maize varieties possessing high productivity and to apply suitable production methods into the new varieties are highly encouraged and recommended. However, there's a problem lying at watering method and frequency. For a long time, maize farmers have kept the old habits of watering several times a day with large amount of water as in their mindset which is that the more water they provide plants, the more productivity they can get. The old habits do not only harm the growth of plants but also the productivity as well as waste labor power. Besides, growing maize requires rather big investment while maize price is low and unstable. Moreover, lack of labor force and rising labor cost lead to less production efficiency of growing maize. The research aims at finding out the impacts of watering method and frequency on growth and productivity of maize. Then, based

on the findings, the research also recommends suitable production techniques that help reduce water usage, adapt to climate changes and boost up production efficiency in agriculture.

2. MEAN AND RESEARCH METHODS

2.1 Time and location of the research

Time: from March 15, 2018 to June 5, 2018

Location: on agriculture land in Truong Long Tay hamlet, Truong Long A commune, Chau Thanh A district, Hau Giang province

2.2 Research method

The research has 2 factors: Factor number 1 is watering method that includes sprinkler watering (A1) and bottom watering (A2); factor number 2 is watering frequency that includes 1-day watering (B1), 3-day watering (B2) and 5-day watering (B3). Split-spot is also used in the research with 4 times repetition and the size of 15 m^2 (5m x 3m) on each formal solution, big spot is 45m^2. The total area used in the test is 1,000 m^2 including production land, causeways and drains and distance between repetitions is 1.2m. The technique used in the test is based on the documents by the Plant Protection Department of Hau Giang province, distance between each plant is 70 cm and between each row is 35 cm. Water used for watering is from local irrigation system. The variety used in the test is the waxy maize with good kernel quality that can meet the market requirements

There are 7 formal solutions in the research, namely:

- Formal solution 1: Sprinkler watering, once a day (A1B1)

- Formal solution 2: Sprinkler watering, once every 3 days (A1B2)

- Formal solution 2: Sprinkler watering, once every 5 days (A1B3)

- Formal solution 4: Bottom watering, once a day (A2B1)

- Formal solution 5: Bottom watering, once every 3 days (A2B2)

- Formal solution 6: Bottom watering, once every 5 days (A2B3)

- Formal compared: compared formal solution based on regular method used by local farmers which is sprinkler watering from seeding then switching to bottom watering during pollination, once a day, irrigation water runs through ditches inside the maize field (DC).

2.3 Collected characteristics

The collected characteristics include: (1) bio-agronomical characteristic: plant height, ear height, number of leaves, root height, stalk diameter; (2) factors contributing to productivity: corncob weight at harvesting, corncob diameter, number of kernels in a row, weight of 1000 kernels at harvesting, weight of 1000 kernels during storage (dried and stored at 14% moisture), ear height, number of corncobs/ plant.

After sowing to 15 days, plants in each formal solution are received the same watering method: 2 times a day to provide enough moisture for plants to grow during early stage. Two factors of the research (including watering method and frequency) are applied after 15 days of sowing (when each plant has 4-5 leaves). The data of plant height, number of leaves/ each plant were collected the first time after 15 days of sowing. After 15 days of sowing, data are regularly collected once every 10 days until 55 days from sowing date (in pollination stage). Other data including root height, stalk diameter, and other factors affecting productivity are collected once during harvesting.

Sample collecting method: uniform distribution on the bias with 5 spots is used in the research. Each spot includes 6 numbered plants (5 spots x 6 plants = 30 plants/once replication)

2.4 Research tools

Maize was grown on alluvium with pH ranging from 4.5 ~ 7.0 during research time. Irrigation water has pH ranging from 7.2 ~ 8.2 (7.6 on average). Tools used for data collecting are tape measure (200 cm ± 2 mm), electronic balance (500 g ± 0,01 mg), seed moisture tester (Tetkit), soil moisture & pH tester, irrigation water pH tester and seed desiccator.

2.5 Data analysis method

Data will be calculated into average values. Then the average numbers of each formal solution will be compared by Two way ANOVA with Ducan test at $\alpha<0.05$.

3. RESULTS

3.1 Soil moisture and pH during research duration

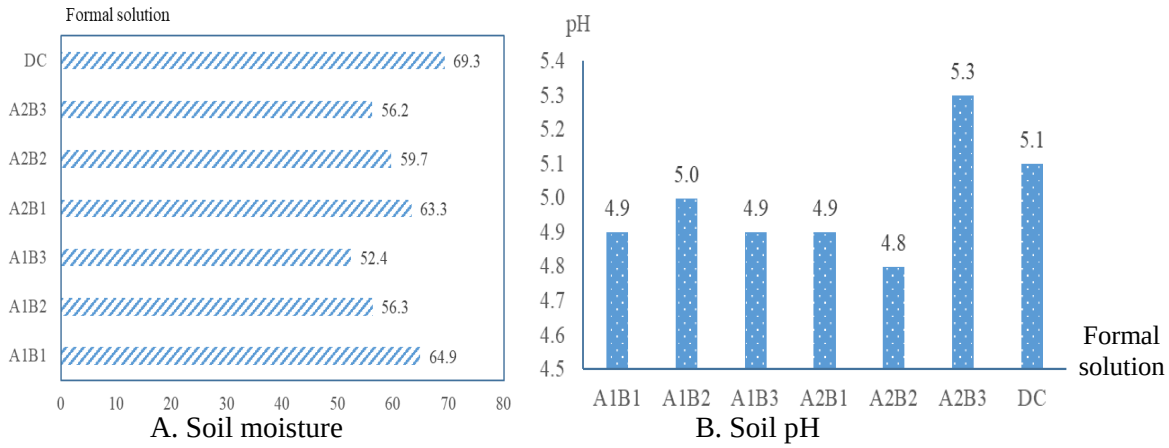

Fig. 1. Soil moisture and pH on tested formal solutions

Based on moisture observation, A1B3 has the lowest moisture (52.4%), followed by A2B3 (56.2%) and DC has the highest moisture of 69.3%. For A2B1 and A1B1, moisture levels are 63.3% and 64.9% respectively while A2B2's and A1B2's are 59.7% and 56.3% respectively. According to Fig. 1, soil moisture of land which is watered once every 3 days (B2) and once every 5 days (B3) by sprinkler, tends to be lower than that by bottom watering.

3.2 Several growing elements of maize

3.2.1 Changes of plant height during research duration

Table 1. Changes of plant height during research duration

Formal solution	H15	H25	H35	H45	H55
A1B1	36.3	83.5	152.6	175.5	189.3
A1B2	36.6	86.7	154.9*	180.3	191.5
A1B3	37.4	88.3	155.2*	177.5	191.0
A2B1	38.5*	91.2*	158.4*	181.1	194.0*
A2B2	36.2	87.3	152.3	174.9	188.9
A2B3	38.2	91.7*	150.8	174.7	186.4*

DC	35.4*	80.8*	146.9*	174.0	191.4
CV%	3.56	6.09	2.78	2.07	1.65
F(A)	0,145	0,016	0,791	0,528	0,513
F(B)	0,113	0,241	0,343	0,407	0,164
F(A*B)	0,173	0,181	0,009	0,006	0,006

Notes: H15: Plant height 15 days after sowing, H25: Plant height 25 days after sowing, H35: Plant height 35 days after sowing, H45: Plant height 45 days after sowing, H55: Plant height 55 days after sowing.

In order to evaluate maize's growth capability through formal solutions, plant height was measured on 15th day after sowing date (H15), on 25th day (H25), on 35th day (H35), on 45th day (H45) and 55th day (H55). This is also the pollination stage and there's no change in plant height.

About plant height, after 25 days of sowing, A2B3 has the highest plant height (91.7 cm), followed by A2B1 (91.2 cm) and the shortest one is DC by farmers (80.8 cm). Statistics analysis shows that, after 35 days of sowing, plant height is affected by watering method and frequency with Sig. of A*B namely 0.009, 0.006 and 0.006 respectively. Also, A2B1 always has the highest plant height as compared to other formal solutions meanwhile DC has the shortest plant height at all grow stages.

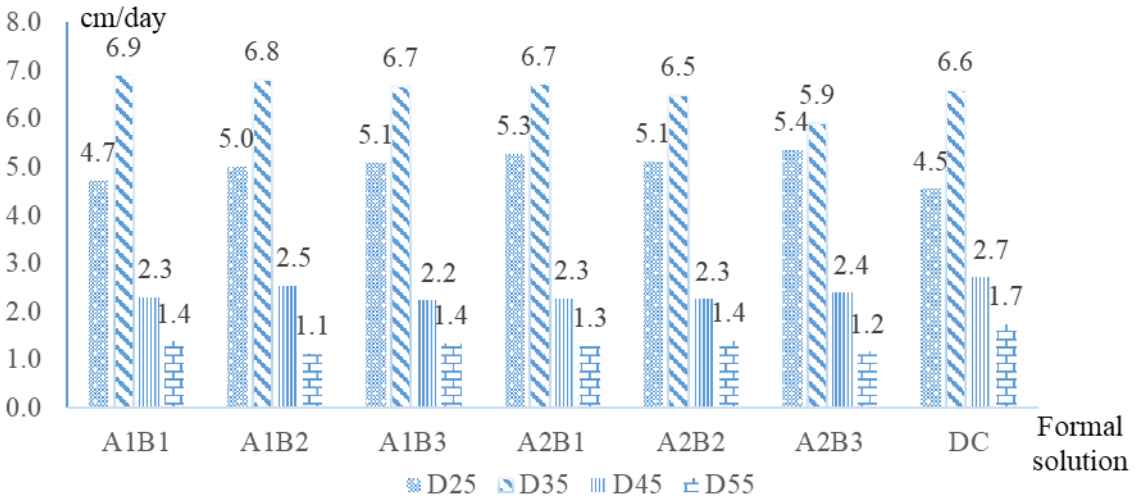

Fig. 2. Growing rate of maize through different stages.

Notes: D25: growing rate after 25 days of sowing, D35: growing rate after 35 days of sowing, D45: growing rate after 45 days of sowing, D55: growing rate after 55 days of sowing.

According to Fig. 2, maize's growing rate reaches the highest speed from 25 days to 35 days after sowing. Of which, A1B1 has the quickest grow rate with the average of 6.9 cm/day and A2B3 is the slowest with 5.9 cm/day. From 45 days, maize's growing rate is gradually slowing down until harvesting time. Results show that, the plants that are watered once every 5 days (B3) have the slowest growing rate while the plants with watering frequency of once every day have the fastest growing rate.

3.2.2 Ear height

Ear height is the distance from the bottom of the stalk to the top node having ear or corn and ear height varies according to gene of each maize variety as well as cultivation method. Suitable plant height and

ear height are important characteristic for easier pollination and for more nutrient kernels. Too high or too low ear heights are both unfavorable for plants. As if it is too high, despite the fact that it is easier for pollination, but the weight of the ear may bend the stalk or even break it. Too low ear height may make it difficult to pollinate that can be unfavorable for productivity and that can affect kernel's quality. According to research results, A2B1 has the highest ear height (85.6 cm), followed by A1B3 (83.6 cm) and A1B1 is the lowest (77.7 cm).

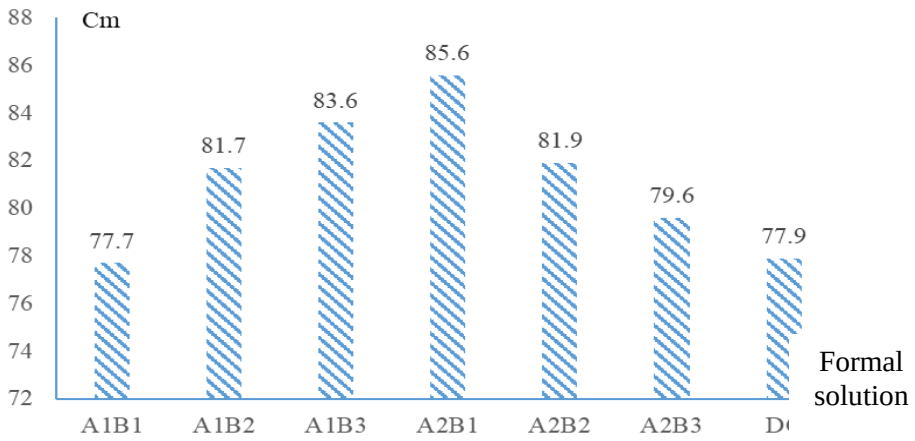

Fig. 3. Ear height of each formal solution

Analysis on the difference of ear height between these formal solutions shows that there's a difference with statistical meaning between formal solutions with $\alpha<0.05$ (Sig. = 0.002). In detail, by using ANOVA, it is shown that there's a difference between A2B1 and DC (Sig.= 0.007) with A1B1 (Sig.= 0.012)

3.2.3 Number of leaves at different stages

Table 2. Number of leaves at different stages of test

Formal solution	L15	L25	L35	L45	L55	LTh
A1B1	9.1	9.0	12.1	12.9	10.4	10.1
A1B2	9.7	9.0	12.2	13.3	11.2	10.6
A1B3	10.2	9.5	11.5	13.2	11.6	11.0
A2B1	9.4	9.9	13.3	13.1	11.4	11.6
A2B2	9.0	10.4	12.2	13.2	10.7	11.4
A2B3	9.6	9.8	13.7	13.4	11.1	10.4
Control	10.5	8.9	13.4	12.8	10.7	10.5
CV%	7.9	5.2	9.7	3.9	6.1	8.7
F(A)	0,061	0,000	0,000	0,449	0,892	0,003
F(B)	0,007	0,091	0,020	0,058	0,020	0,358
F(A*B)	0,026	0,000	0,000	0,318	0,000	0,000

Notes: L15: number of leaves/plant 15 days after sowing, L25: number of leaves/plant 25 days after sowing, L35: number of leaves/plant 35 days after sowing, L45: number of leaves/plant 45 days after sowing, L55: number of leaves/plant 55 days after sowing.

From observation, number of leaves keeps increasing and at the fastest rate during 25 days to 35 days after sowing. At this time, speed of leaf emerging of DC is the quickiest, about 0.45 leaf/day and A2B2 is the slowiest (0.18 leaf/day) after 35 days. The number of leaves/plant reaches its peak during the period of 35 days to 45 days after sowing then it decreases until harvest. Statistic analysis shows that there are impacts from watering method and frequency on the number of leaves/plant during the plant's growth stages.

3.2.4 Root height

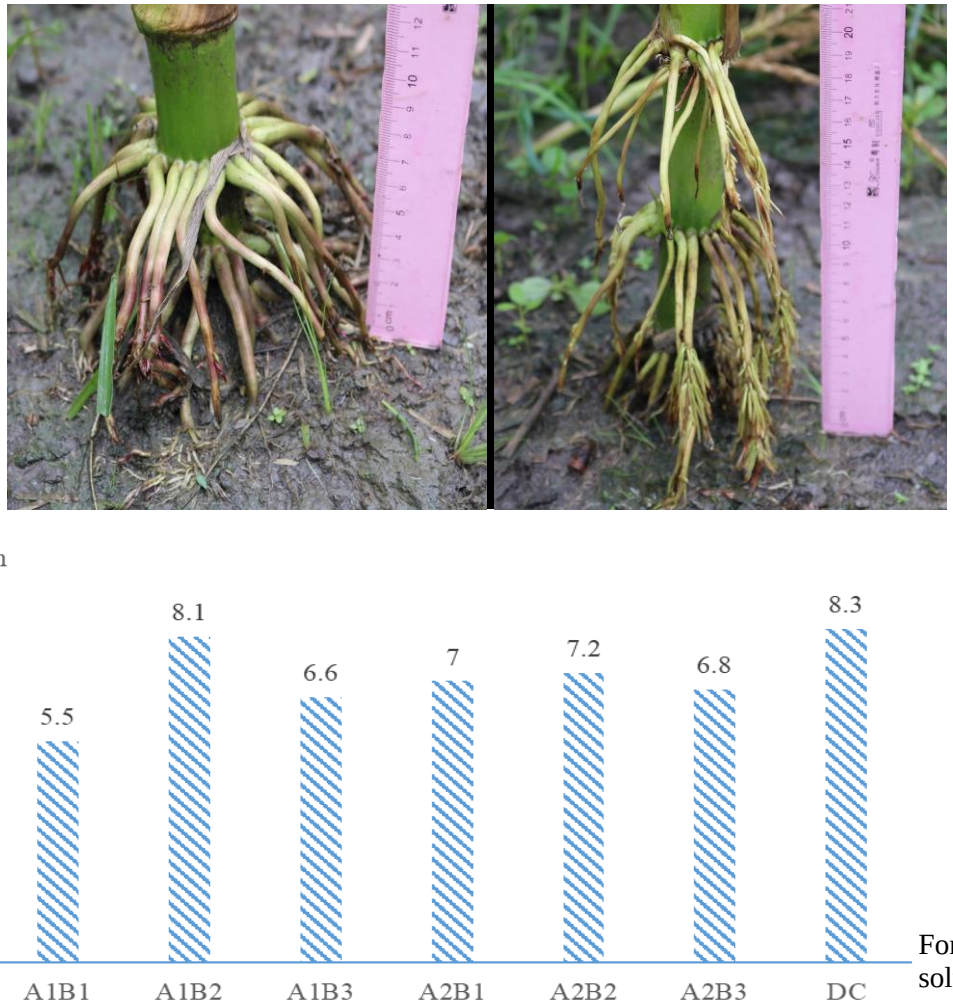

Fig. 4. Maize root height of each formal solution

Root height is the distance from land surface to the highest point of root on stalk. According to research results, DC has the longest length of root (8.3 cm), followed by A1B2 (8.1 cm) and the shortest is A1B1 (5.5 cm). Root height reflects the anti-break capability of plant therefore the higher the root height is the harder for plant to be bent or broken. Research shows that watering method and frequency have impacts on maize root height with Sig. of A*B 0.02<0.05. Of which, A1B1 is different from A1B2 and DC at α<0,05.

3.2.5 Stalk diameter

Samples of stalk diameter were taken once during harvesting. Stalk diameter reflects anti-break capability in severe weather conditions, especially in seasons that have strong wind. According to research results, A2B1, A2B2 and DC have the same stalk diameter (2.7 cm) while A1B1, A1B2 and A1B3 are 2.6 cm. A2B3 have the shortest stalk diameter of 2.5 cm.

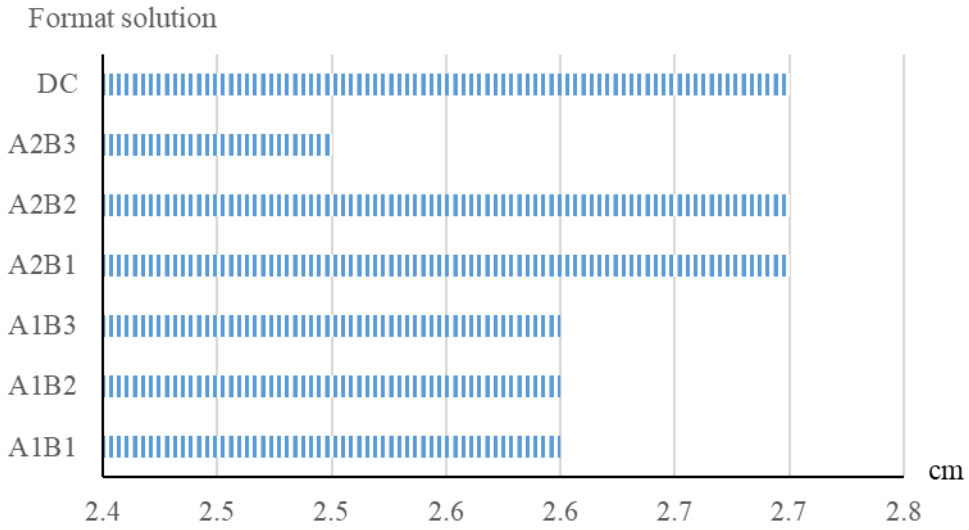

Fig. 5. Stalk diameter of each formal solution

3.3 Several characteristics about maize productivity

Productivity is an important element in the research as this is a general element to evaluate the growth and development process through formal solutions corncobs/plant, weight of a fresh corncob, diameter of a corncob, weight of 1000 kernels, weight of 1000 kernels after being dried and stored.

3.3.1 Number of corncobs on a plant

According to Fig. 6, A2B2, A2B3 and DC have the biggest number of corncobs/plant (average of 2.1 corncobs/plant), followed by A2B1 (average of 2 cornbobs/ plant), then A1B1 (1.9 corncobs/ plant) and A1B2, A1B3 (average of 1.8 corncobs/ plant).



Fig. 6. Number of corncobs/ plant of each formal solution

3.3.2. Corncob weight, diameter and weight of 1000 kernels

Table 3. Characteristics affecting maize productivity of each formal solution

Formal solution	*Weight of corncob*	*Diameter of corncob*	*Length of corncob*	*Number of kernel/row*	Yield (100kg/ha)
A1B1	193.0	5.1	16.1	22.6	58.4
A1B2	195.6	5.2	16.2	22.8	65.5
A1B3	164.7	5.0	14.6	21.0	53.4
A2B1	179.3	5.1	15.2	21.9	49.1
A2B2	187.6	5.0	17.4	21.8	56.5
A2B3	167.0	4.9	15.3	21.1	51.9
DC	165.7	4.9	15.5	20.5	43.5
CV%	9.09	2.78	4.54	7.10	12.4
F(A)	0,350	0,139	0,416	0,447	
F(B)	0,006	0,062	0,000	0,284	
F(A*B)	0,630	0,469	0,020	0,839	

Notes: Weight of corncob: weight of corncob when haversting (gram), Diameter of corncob (cm). Length of corncob (cm); Number of kernel/row (kernel), Yield: productivity in reality (100 kilograms/ hectare).

- Weight of corncob when harvesting: According to analysis, A1B2 has the biggest average weight of corncob (195.6 g), followed by A1B1 (193.0 g) and DC has the smallest corncob weight of 165.7 g. For formal solutions with watering frequency of once every 5 days, the average weight of corncob is smaller than that of formal solutions with watering frequency of once everyday and once every 3 days. Results show that there's a difference between formal solutions with different watering frequency at α=0.05 (Sig.=0.006).
- Diameter of corncob: Diameter of corncob ranges from 4.9 to 5.2 cm among formal solutions. Of which, A1B2 has the biggest diameter of corncob (5.2 cm) and the smallest are A2B3 and DC (4.9 cm). Results also show that, in the situation of lack of water or too much water, diameter of corncob is smaller than when maize is supplied enough water (once every 3 days).
- Length of corncob: Length of corncob ranges from 14.6 cm to 17.4 cm among formal solutions. Of which A2B2 has the longest length of 17.4 cm, followed by A1B2 16.2 cm and the shortest is A1B3 14.6 cm.
- Number of kernels/ row: Number of kernels/ row of these formal solutions ranges from 20.5 to 22.8 (kernels/ row). Of which A1B2 has the most kernels/ row of 22.8, followed by A1B1 22.6 and DC is the least of 20.5 kernels/ row.
- Weight of 1000 kernels: According to research results, weight of 1000 kernels when harvesting of A1B2 is the heaviest (395.2 g), followed by A2B2 395.0 g and the lightest is DC 353.6 g. Weight of 1000 kernels after being dried to the moisture of 14% (suitable moisture for storage) of A2B2 is the heaviest of 148.6 g, followed by A1B1 142.9g, A1B2 is 142.3 g and the lightest is DC 119.0 g.
- Productivity in theory: Research shows that A1B2 has the highest productivity of 6,680 kg/hectare, followed by A1B3 with 6,140 kg/hectare and DC has the lowest productivity of 4,740 kg/hectare. Formal solutions using sprinkler watering method have higher productivity as

compared to other formal solutions using bottom watering. For watering frequency, formal solutions with watering frequency of once every 3 days have the highest productivity.

- Productivity in reality: According to research results, A1B2 has the highest productivity of 6,550 kg/hectare, DC has the lowest productivity of 4,350 kg/hectare. It is also clear that, in the situation of lacking water or too much water, maize plants can not grow well resulting in decreased productivity.

3.3.3 Other characteristics regarding pollination period, silk elongation period and physiological maturity period

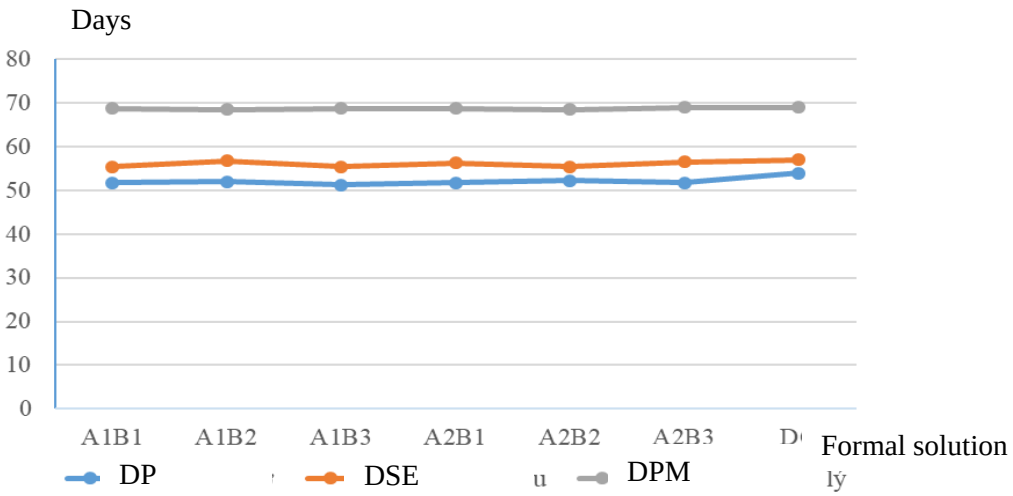

Fig. 7. Days of pollination (DP), silk elongation (DSE) and physiological maturity (DPM) among formal solutions

- Time of pollination: Time of pollination among formal solutions ranges from 51.3 to 54 days. DC has the longest pollination time of 54 days from sowing date, followed by A2B2 with 52.3 days and A1B3 has the shortest pollination time of 52 days.
- Time of silk elongation: According to Fig. 7, the average number of days until silk elongation period are 55.5 to 57 days from sowing date. Of which, DC has the longest time of 57 days, followed by A1B2 56.8 days and the shortest are of 3 formal solutions of A1B1, A1B3 and A2B2.
- Time of physiological maturity: After pollination, kernels are developed and grain starts filling and nutrient is transported to cob. This stage is the last stage in maize growth stages. The stage starts when black spot appears in the bottom of a kernel and when stalk turns yellow, leaves turn dry. Also in this stage, all kernels are drying out. DC and A2B3 have the longest time of physiological maturity of 69 days, followed by A1B1, A1B3 and A2B1 of 68.8 days and the shortest is of A1B2 and A2B2 68.5 days.

According to research results, duration between pollination and silk elongation period of A1B2 and A2B3 is the longest 4.8 days, duration between silk elongation period to physiology maturity of A1B3 is the longest.

3.3.4 Outcome of the model

Table 4. Cost and profit calculation of maize cultivation by farming households

Number	Content	Amount of money
1	Invested cost *(USD/hectare)*	1.044,22
2	Revenue *(USD/hectare)*	1.870,95
3	Profit *(USD/hectare)*	857,13
4	Profit/Invested cost ratio *(USD/hectare)*	0.82

According to Table 4, invested cost is USD 1.044,22 per hectare, revenue is 1.870,95 per hectare and profit is 857,13 per hectare. The ratio of profit/invested cost is 0.82 meaning that farmers can earn 0.82 USD profit when each 1 USD is invested.

4. DISCUSSION

Soil is one of the major factors that have considerable effects on the growth, development and productivity of plants. Maize is one of the plants that can grow well on rich soil or mixed sandy soil with pH ranging from 4.5 to 7.0 (Tinh Ngo Huu, 2003). Soil in the research has pH from 4.8 to 5.3 and this is the suitable pH level for maize to grow. Watering method and frequency have mutual effects.

For maize, increase in plant height is one of the elements that can reflect rather correctly about the growth and development of the plant during different stages. This kind of morphology onws close relation with other factors namely cultivation technique, gene, physiologic characteristics and biochemistry. According to Tinh Ngo Huu (2013), maize's plant height is in positive correlation with the capability of absorbing sunlight, anti-break and plant density. According to research results by Loan Duong Thi et al. (2014), lack of water will considerably affect to the growth and development of stalk. During drought or lack of water, maize tends to reduce growing duration as compared to maize that grows in the condition of enough irrigation water.

Similarity to plant height, number of leaves/plant is also a characteristic which reflects the plant's growth and development capability. Leaf plays the leading role in photosynthesis, nutrient cumulation for the growth and development of the plant and kernels. The quicker the speed of leaves emerging is, the better the plant grows and vice versa. According to Van Long Thuy (2015), the number of leaves/ plant is an important characteristic to productivity and kernel quality. The characteristic is considerably impacted by weather conditions, cultivation method, variety, etc. of which variety and climate have major impacts. However, change in the number or leaves/plant of each formal solution at each stage is not big and it has close correlation with the plant's growth. During germination and cob development, the number of leaves is not many and this number gradually increases and reaches the peak at pollination then starts decreasing until harvest.

The results are also matched with the research results by Duc Nguyen Van et al. (2017) which found out that maize has the fastest growing rate during the period of 35 – 42 days after sowing and after 49 days since sowing, the growing rate slows down as maize is in pollination stage. According to Loan Duong Thi et al. (2014), drought is one of the biggest difficulties interfering agriculture production. Therefore, research on drought-tolerance characters of maize is needed in the context that maize has become a suitable option for crop composition conversion on rice land. Therefore, applying suitable cultivation technique and watering frequency will help farmers to have proper crop composition that can adapt to climate changes in the near future.

5. CONCLUSION

Research on the growth, development of maize has an important role in science and agriculture production as well as has impact on crop composition and in proper production technique selection to adapt well with current status of climate changes.

According to research results, growing rate reaches the highest at 25-35 days after sowing while A1B1 formal solution has the highest growing rate as compared to other formal solutions.

A2B1 has the longest ear height. Corncob weight and diameter, weight of 1000 kernels when harvesting, productivity in theory and in reality of A1B2 (formal solution of sprinkler watering, 3 times a day) are the highest. Based on physiological maturity observation, A1B2 (formal solution of sprinkler watering, 3 times a day) and A2B2 (formal solution of bottom watering, 3 times a day) have the shortest physiological maturity. As found in the test, using sprinkler watering once every 3 days has significant impacts on the maize productivity. According to calculation on the tested crop, invested cost is 1.044,22 while profit is 857,13 then profit/invested cost ratio is 0.82.

ACKNOWLEDGEMENTS

Our special thanks go to SD=HS Project for funding; family of Mr. Nguyen Thanh Liem at Truong Long Tay hamlet, Truong Long A commune, Chau Thanh A district, Hau Giang province; local authorities in the research areas and students of Agriculture Technique Department, Rural Development College for helping and supporting us in conducting the research.

REFERENCES

1. Ministry of Agriculture and Rural Development, 2011, National technical regulation on testing for Value of Cultivation and Use of Maize varieties, Circular no 67/2011/TT-BNNPTNT dated 17 October, 2011.
2. Loan, D.T., Ha, T.T.T., Hanh, V.T.B. and Liet, V.V., 2014, Evaluation of Drought Tolerance of Waxy Maize Inbred Lines and Their Hybrids, Journal of Science and Development, No 08/12/2014: 1202-1212.
3. Loan, D.T., Hanh, V.T.B., Ha, N.V., Ha, T.T.T., Thuy, H.T. and Liet, V.V., 2016, The Effect of Nitrogen Concentrations Applied and Plant Density on Some Physiological, Yield Trait of Waxy Maize HUA518, Vietnam Journal of Agricultural Sciences Vol 14, no 6: 833-842
4. Kwanchai A. Gomez and Arturo A. Gomez, 1984, Statistical Procedures for Agricultural Research (2nd Edition), Publication: John Wiley & Sons, Canada, 680 pages.
5. Kha, L.Q, 2001, Effect of water and nitrogen lacking to pre-stage of pollination and other characteristics of yield and yield of tropical maize, Journal of Science and Development, No 04/2001: 221-222.
6. Van, L.T., 2015, Research on impacts of density and fertilizer to growth and development of maize VS36 in Lai Chau province, Master of Plant Science Thesis, Thai Nguyen University of Agriculture and Forestry.
7. Tinh, N.H., 1995, Research on Maize Production on 1-crop-per-year land in the Northwest mountainous areas, Hanoi Agriculture Publishing house, Ha Noi.
8. Tinh, N.H., 2003, Maize, Nghe An Publishing house, 211 pages.
9. Duc, N.V., Thuan, L.D., Thong, C.V.T., 2017, Studying to determine hybrid corn and appropriate planting density in Phu Yen province Vietnam Journal of Agricultural Sciences Vol 1 1 (1)-2017: 55-65.

10. Thien, T.D., 2014, Effect of Granular Nitrogen Fertlizer on Growth, Development and Performance of Hybrid Maize cv, C919 in Vinh Loc district, Thanh Hoa province. Journal of Science and Development, No 04/12/2014: 495-501.
11. General Statistic Bureau, 2017, Annual abstracts of statistics of Hau Giang 2016, Statistics Publishing House, 324 pages.