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# Estimating The Effective Control of Ditacin 8sland Sat 4slwith Tobacco Mosaic Virus (TMV), Cucumber Mosaic Virus (CMV), And Potato Virus Y (PVY) on Tobacco Plants

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***Abstract:*** *In recent years, viral diseases have been developing strongly and causing significant damage to the yield and quality of tobacco in Vietnam such as TMV, CMV, and PVY. The objective of this study was to estimate the effective control of some antivirus agents and technical controls for the virus diseases on the tobacco plants. Two antivirus agents, Ditacin 8SL (Ningnanmycin) and Sat 4SL (Cytosinpeptidemycin) were performed in the net-house and field condition in Bac Giang province in 2019, Vietnam.The field experiment was arranged in a randomized complete block design with three replications.In net-house, a result of treating Ditacin 8SL from 3 to 6 times before infected plants had effective control of PVY with ranging from 24 - 33%; TMV: 28,9 - 50%; and CMV: 42,6 - 60% after 21 days of inoculation. For Sat 4SL, effective control of TMV ranged from 23,7 – 31,6%; CMV: 20,0 - 24,4% and PVY: 28,9 - 35,6% after 21 days of inoculation. In the field condition, the effective control of NNM was 100% for TMV; PVY: 93,5%; CMV: 60,5% and TNRV: 52,1%. Similar to Ditacin 8SL, treating Sat 4SL, the effective control of TMV reached 70,9%; CMV: 58,3%; PVY: 96,4% and TNRV: 36,9%. Spraying Ditacin 8SL and Sat 4SL in the stage from transplanting (3 - 4 leaves/plant) to 16 - 18 leaves/plant were the best control of viral diseases, increased the yield, grade index, and less impact on the property of smoke. Our conclusions showed the Ditacin 8SL and Sat 4SL were effective in controlling TMV, CMV, PVY, and TNRV on tobacco plants. To effectively manage virus diseases of CMV, PVY, and TNRV, have to spray a mixture of virucide, insecticide, and foliar fertilizer, with TMV only uses the virucide and foliar fertilizer, and destroy all disease plants.*

***Keywords****: Tobacco, Virucide, Ningnanmycin,* Cytosinpeptidemycin, *Virus, TMV, CMV, PVY*

## I. Introduction

Viral diseases often threaten the sustainable development of agricultural production in the world. They infected a lot of crop plant species and estimated annual losses worldwide of about $600 billion. Tobacco mosaic virus (TMV), the type member of the Tobamovirus genus, is a prevalent plant pathogen all over the world and has the widest host range of over 885 plant species in 65 families. Most TMV has infected some economically important crops and has induced general mosaic symptoms to cause significant economic losses worldwide. It is found that in certain fields 90 - 100% of the plants show mosaic or leaf necrosis by harvesting time (Ziwen Wang et al. 2012). Potato virus Y belongs to a group of the most important potato viruses infecting the potato, tobacco, pepper, and tomato. PVY causes major yield losses of up to 80% in potato crops and can reach 100% in tobacco (Florence Faurez et al. 2012).

The prevention of viral diseases that harm crops with chemical agents is impossible because they are species that are a parasite the cell. Using chemicals only have the effect of inhibiting the development of viruses

leads to reduce disease symptoms in the plants. There are no control measures that can inhibit plant viruses after they have infected plants. Currently, some chemicals can prevent the development of viruses such asNingnanmycin (NNM), Cytosinpeptidemycin, Salicylic acid (SA), Flavonoid, Terpenes. In there, Ningnanmycin, Cytosinpeptidemycin, Salicylic acid were used widely in China to control some viral diseases on the tobacco plants and others.Ningnanmycin, perhaps the most successful registered antiplant viral agent, displayed 56,0% in vivo curative effect at 500 µg/mL. For TMV, the effective control of NNM was over 56% when spraying at a dose of 500 µg mL-1 (Ziwen Wang et al. 2012).Salicylic acid (SA) induced resistance to Cucumber mosaic virus (CMV) in tobacco (Nicotiana tabacum) results from inhibition of systemic virus movement and is induced via a signal transduction pathway that also can be triggered by antimycin A, an inducer of the mitochondrial enzyme alternative oxidase (AOX). Cytosinpeptidemycin (CytPM) is a microbial pesticide that displayed broad-spectrum antiviral activity against various plant viruses. CytPM could effectively delay the systemic infection of tobacco mosaic virus (TMV) in *Nicotiana benthamiana* and significantly inhibit the viral accumulation in tobacco BY-2 protoplasts. Results of RNA-seq indicated that 210 and 120 differential expressed genes (DEGs) were significantly up and down-regulated after CytPM treatment in BY-2 protoplasts, respectively (Mengnan An et al. 2019).

In recent years, some viral diseases have been increasing quickly in the tobacco-growing regions of Vietnam, and cause more damage than some fungal, bacterial, and other diseases. They significantly harmed the yield and quality of tobacco.In there, TMV, CMV, and PVY are the most common pests in the tobacco field. For example, TMV occurred very generally in the field with disease incidence ranging from 3,5% to 90%; CMV from 0,8% to 9,5%; and PVY from 2,1% to 31,5%. The growth of viral diseases depended on variety, cultivation, region, climate, and weather conditions of annual. To manage the effect of viral diseases on tobacco plants, testing of some virucides is very necessary and has significant practice.

## II. Material And Methods

**The study site**

The study was conducted in the Bac Giang province, Vietnam from January to June 2020. The experimental field station was annually infected from medium to high levels with some viral diseases of TMV, CMV, and PVY.

**Material and object**

Using product trade namedDitacin 8SL (active ingredients (ai): Ningnanmycin) and Sat 4SL (ai: Cytosinpeptidemycyn) were tested in the net-house and field conditions with the tobacco variety C9-1. C9-1 was very sensitive to some viral diseases of TMV, CMV, and PVY. The typical infective plants were collected from the field and transplanted in a net-house and tested by the RT - PCR method in the Institute of Biotechnology, Vietnam.

**Tests under the net-house condition**

The seed of C9-1 was sown on free pathogen nursery and quarantined vector insects by insectnets. When the seedlings reached 2 - 3 leaves, planted into the vessels and inoculated when they reached 4 - 6 leaves. Each treatment was inoculated about 30 plants with 6 treatments, including CT1 (SP2+IN): spraying 2 times of virucide then inoculation; CT2 (SP3+ IN): spraying 3 times of virucide then inoculation; CT3 (SP3+ IN +P3): spraying 3 times of virucide then inoculation and spray more than 3 times; CT4 (IN+SP2): Inoculating then spraying 2 times of virucide; CT5 (IN +SP3): Inoculating then spraying 3 times of virucide; CT6 (Control): Inoculating and do not spray virucide. CT1, CT2, and CT3 were inoculated after 1 hour of the final spraying times; CT4 and CT5: spraying virucide after 1 hour inoculation. Spraying a dose of Ditacin 8SL was 12 ml/8 liters of water and Sat 4 SL: 15ml/8 liters of water, and per spraying separated 6 days.

Inoculation method (Yasir Iftikhar et al. 2018): The infected leaves were ground in the potassium phosphate buffer with 1 gram infected leaf/2ml solution of buffer (0,1M and pH = 7). Using absorbent cotton soaked in the disease solution and rubbed gently on the leaf surface of 3 young leaves from the leaf stalk to the leaf tip. Before inoculation, the three young leaves of experimental plants were blown with Carborundum 600 mesh. The inoculative leaves were washed after 15 - 20 minutes of inoculation by freshwater.

**Tests under the field condition**

Tobacco variety C9-1 were sown on a free pathogen nursery. When the seedlings reached 4 - 6 leaves and planted them in the experimental field with a distance from the plant to another plant about 0,5m and space between rows about 1,1m. Rates of fertilizers were used for the experiment as 70N: $140P_2O_5$: $210K_2O$ kg/ha with a form of N: $NH_4NO_3$ and K: $K_2SO_4$. Around the experiment was planted 3 rows of tobacco to protect the experimental field. The field experiments were designed a randomized complete block with three replications. The experiments were sprayed 5 times on February 15, 22, and 28, March 9 and 16, from the transplanting stage to stage of 16 - 18 leaves/plant. The viral diseases were developed freely in the field condition, did not spray insecticide to control vector insects, and did

not destroy the infective plants.

**The target surveillance**

In the net-house: Surveying disease incidence and disease severity after 10, 15, and 21 days of inoculation. In the field: Surveying disease incidence and disease severity with 10 days per times. Disease severity of PVY was assessed following to 6 levels of Arinaitwe Abel Byarugaba et al. 2020; TMV: 4 levels of Wang et al. 2009, and CMV: 5 levels of K. Nadarajah, N.M et al. 2009.

The technical process of cultivation (planting, fertilizing, cultivating, watering), picking and curing according to the technical process of producing flue-cured tobacco following some standards of Vietnam and Coresta such as 10TCN 618 – 2005; Grade dry leaf tobacco: TCN 26-1-02; Smoking method: TC 01-2000. Analyzing chemical components following some standards of Vietnam and Coresta such as Nicotine: TCVN 7103: 2002 (ISO 2881:1992), sugar: TCVN 7102: 2002, and Coresta: 38:1994. The effective control (EC%): (1 - (Ta/Ca) x100), Ta: Disease severity index of treatment after spraying virucide, and Ca: Disease severity index of control after spraying.

**Study Duration:** Janaury to Jun 2019.

**Statistical analysis**

Collected data were treated by Excel software and Statistix 8.2.

## III. Result

**Effective control of Ditacin 8SL, Sat 4SL withTobacco mosaic virus (TMV), Cucumber mosaic virus (CMV), and Potato virus Y (PVY) in the net-house condition**

***Effective control of Ditacin 8SL***

The disease index and effective control of Ditacin 8SLwith TMV, CMV, and PVY in net house condition in spring 2020 in Bac Giang province were summarized in table 1.

Results of surveillance in table 1 showed all infective plants that were sprayed Ditacin 8SL and non-spraying appeared the disease symptoms with a rate of 100%. But the disease severity index of plants was sprayed by Ditacin 8SL was milder than plants that were not treated. For example, with TMV, after 10, 15 and 21 days of inoculation, disease index of some spraying treatments were ranging from 37,5% to 47,5% and control: 70%; 45,0 - 55,0% (control: 80%), and 47,5 - 72,5% (control: 95%); With CMV: 32,0 - 54,0% (control: 64%); 34,0 - 56,0% (control: 68%), and 38,0 - 58,0 (control: 90%). For the PVY, disease index of some spraying treatments were ranging from 26,0% to 66,0% (control: 84%), 56,0 - 70,0% (control: 88%), and 60,0 - 78,0% (control: 90%) after 10, 15 and 21 days of inoculation.

The tobacco plants that were sprayed by Ditacin 8SL were able to inhibit strongly for growth and spread of the virus in tobacco plants after 10 - 15 days of inoculation with effective control ranging 31,3 - 46,1% for TMV, and 21,4 - 69,0% with PVY. However, after 21 days of inoculation, effective control of TMV and PVY reduced and ranged from 23,7 - 28,9% and 13,3 - 33,3%. Except for CT3 (spraying 3 times, then inoculating and spraying 3 times), the effective control increased after 21 days of inoculation and reached 50,0% with TMV. For CMV, effective control increased 10, 15 and 21 days after inoculation with effective control corresponding 15,6 – 50,0%; 17,6 - 50% and 35,6 - 57,8%.

In 5 spraying treatments, CT3 (spraying 3 times, then inoculating and spraying 3 times) was the best control after 21 days of inoculation for TMV, CMV, and PVY. For example, effective control of TMV was 50,0%, PVY: 33,3%, and CMV: 57,8%. CT4 (inoculating after spraying 2 times) was the lowest control with the effective control of TMV: 23,7%, PVY: 13,3%, and CMV: 35,6% after 21 days of inoculation (fig 1).

The treated tobacco plants by Ditacin 8SL before the infection had a higher antiviral effect than infected plants after praying virucide. Details of after 21 days of infection, disease index of tobacco plants were treated by Ditacin 8SL before infection was ranging from 38 to 46% with CMV; TMV: 47,5 - 70,0% and PVY ranging: 60,0 - 74,0%.In contrast, the infected tobacco plants that treated by Ditacin 8SL had a higher disease index with a disease index of TMV: 70,0 – 72,0%, CMV: 54,0 – 58,0%, and PVY: 72,0 – 78,0%.

**Table no 1:** The disease index and effective control of Ditacin 8SL with TMV, CMV, and PVY in net-house in Bac Giang province, Vietnam

| Treatment | Disease incidence | 10 days | | 15 days | | 21 days | |
|---|---|---|---|---|---|---|---|
| | | DI | EC | DI | EC | DI | EC |
| TMV (%) | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CT1: SP2+ IN | 100 | 47,5 | 32,1 | 55,0 | 31,3 | 70,0 | 26,3 |
| CT2: SP3+ IN | 100 | 42,5 | 39,3 | 47,5 | 40,6 | 67,5 | 28,9 |
| CT3: SP3+ IN +SP3 | 100 | 37,5 | 46,1 | 45,0 | 43,8 | 47,5 | 50,0 |
| CT4: IN +SP2 | 100 | 45,0 | 35,7 | 55,0 | 31,4 | 72,5 | 23,7 |
| CT5: IN+SP3 | 100 | 47,5 | 32,1 | 52,5 | 34,4 | 70,0 | 26,3 |
| CT6 (Control) | 100 | 70,0 | | 80,0 | | 95,0 | |
| CMV (%) | | | | | | | |
| CT1: SP2+ IN | 100 | 42,0 | 34,4 | 44,0 | 35,3 | 46,0 | 48,9 |
| CT2: SP3+ IN | 100 | 36,0 | 43,8 | 40,0 | 41,2 | 40,0 | 55,6 |
| CT3: SP3+ IN +SP3 | 100 | 32,0 | 50,0 | 34,0 | 50,0 | 38,0 | 57,8 |
| CT4: IN +SP2 | 100 | 54,0 | 15,6 | 56,0 | 17,6 | 58,0 | 35,6 |
| CT5: IN+SP3 | 100 | 48,0 | 25,0 | 54,0 | 20,6 | 54,0 | 40,0 |
| CT6 (Control) | 100 | 64,0 | | 68,0 | | 90,0 | |
| PVY (%) | | | | | | | |
| CT1: SP2+ IN | 100 | 36,0 | 57,1 | 70,0 | 20,5 | 74,0 | 17,8 |
| CT2: SP3+ IN | 100 | 30,0 | 64,3 | 66,0 | 25,0 | 68,0 | 24,4 |
| CT3: SP3+ IN +SP3 | 100 | 26,0 | 69,0 | 56,0 | 36,4 | 60,0 | 33,3 |
| CT4: IN +SP2 | 100 | 66,0 | 21,4 | 68,0 | 22,7 | 78,0 | 13,3 |
| CT5: IN+SP3 | 100 | 50,0 | 40,5 | 66,0 | 25,0 | 72,0 | 20,0 |
| CT6 (Control) | 100 | 84,0 | | 88,0 | | 90,0 | |

*Note: DI: Disease index and EC: Effective Control, SP: spraying virucide, IN inoculation*

***Effective control of Sat 4SL***

The table 2 showed all infected plants that were sprayed with Sat 4SL and non-spraying appeared symptoms of the disease with a rate of 100%. But the disease severity of the sprayed plants was milder than plants that were not treated (Fig 2). For example, with TMV, after 10, 15 and 21 days of inoculation, disease index of some spraying treatments were ranging from 30,0% to 55,5% (control: 70,0%); 47,0 - 67,5% (control: 80%); and 65,0 - 82,5% (control: 95%); With CMV: 42,0 - 56,5% (control: 64%); 46,0 - 60,5% (control: 68,0%); and 68,0 - 86,0 (control: 90%). For the PVY, disease index of some spraying treatments were ranging from 46,0% to 76,0% and control: 84,0%; 56,0 - 86,0% and control: 88%; 58,0 - 86,0% and control: 90,0% after 10, 15 and 21 days of inoculation. The tobacco plants that were sprayed by Sat 4SL were able to inhibit strongly for growth and spread of virus in tobacco plants after 10 days of inoculation with effective control ranging 20,7 - 57,1% for TMV; PVY: 11,7 - 34,4%, and PVY: 9,5 - 45,2%. After 21 days of inoculation, effective control of TMV, CMV and PVY reduced strongly and only reached ranging from 13,2 - 31,6%; 9,5 – 24,4% and 4,4 - 28,9%.

The same by Ditacin 8SL, tobacco plants of treatment that weresprayed 3 times, inoculating and spraying more 3 times by Sat 4SL was the best control after 21 days of inoculation for TMV, CMV, and PVY. The treated tobacco plants by Sat 8SL before infection have a higher antiviral effect than infected plants after praying virucide.

**Table no 2:** The disease index and effective control of Sat 4SL with TMV, CMV, and PVY in net-house in Bac Giang province, Vietnam

| Treatment | Disease incidence | 10 days | | 15 days | | 21 days | |
|---|---|---|---|---|---|---|---|
| | | DI | EC | DI | EC | DI | EC |
| TMV (%) | | | | | | | |
| CT1: SP2+ IN | 100 | 35,0 | 50,0 | 57,5 | 28,1 | 72,5 | 23,7 |
| CT2: SP3+ IN | 100 | 35,0 | 50,0 | 52,5 | 34,4 | 72,5 | 23,7 |
| CT3: SP3+ IN +SP3 | 100 | 30,0 | 57,1 | 47,5 | 40,6 | 65,0 | 31,6 |
| CT4: IN +SP2 | 100 | 55,5 | 20,7 | 67,5 | 15,6 | 82,5 | 13,2 |
| CT5: IN+SP3 | 100 | 50,0 | 28,6 | 65,0 | 26,5 | 75,0 | 21,1 |
| CT6 (Control) | 100 | 70,0 | | 80,0 | | 95,0 | |
| CMV (%) | | | | | | | |
| CT1: SP2+ IN | 100 | 50,0 | 21,9 | 55,0 | 19,1 | 76,0 | 15,6 |
| CT2: SP3+ IN | 100 | 42,0 | 34,4 | 48,0 | 29,4 | 72,0 | 20,0 |
| CT3: SP3+ IN +SP3 | 100 | 42,0 | 34,4 | 46,0 | 32,4 | 68,0 | 24,4 |
| CT4: IN +SP2 | 100 | 56,5 | 11,7 | 60,5 | 11,0 | 86,0 | 9,5 |
| CT5: IN+SP3 | 100 | 52 | 18,8 | 56,5 | 16,9 | 80 | 15,8 |
| CT6 (Control) | 100 | 64,0 | | 68,0 | | 90,0 | |
| PVY (%) | | | | | | | |
| CT1: SP2+ IN | 100 | 54,0 | 35,7 | 64,0 | 27,3 | 68,0 | 24,4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CT2: SP3+ IN | 100 | 48,0 | 42,9 | 58,0 | 34,1 | 64,0 | 28,9 |
| CT3: SP3+ IN +SP3 | 100 | 46,0 | 45,2 | 56,0 | 36,4 | 58,0 | 35,6 |
| CT4: IN +SP2 | 100 | 76,0 | 9,5 | 86,0 | 5,3 | 86,0 | 4,4 |
| CT5: IN+SP3 | 100 | 66,0 | 21,4 | 78,0 | 11,4 | 80,5 | 10,6 |
| CT6 (Control) | 100 | 84,0 | | 88,0 | | 90,0 | |

*Note: DI: Disease index and EC: Effective Control, SP: spraying virucide, IN inoculation*

So, the effective control of Ditacin 8SL with TMV, CMV, and PVY was better than Sat 4SL in the experimental net-house condition in the spring of 2020 in Bac Giang province.

**Effective control of Ditacin 8SL, Sat 4SL with Tobacco mosaic virus (TMV), Cucumber mosaic virus (CMV), and Potato virus Y (PVY) in the field condition**

***Effective control***

In the spring of 2020, in addition to TMV, CMV, and PVY, Tomato necrotic ringspot virus (TNRV) also caused strong harm in Bac Giang province. TNRV belonged to the genus Tospovirus was first discovered in the tobacco plants in Vietnam in 2019, and spread in the field by thrips. So, the topic of surveying on the effectiveness of virucides with TNRV, and the results are shown in Table 3.

The data of table 3 showed that tobacco plants that were sprayed with Ditacin 8SL and Sat 4SL with 6 spraying times in the period of 4 - 6 leaves/plant to 16 - 18 leaves/plant had effective prevention of viral diseases in the tobacco plants. In there, the Ditacin 8SL was the most effective control of 93,6 - 100% with TMV and PVY; CMV: 60,5%; and TNRV: 52,1%. Similar to Ditacin 8SL, Sat 4SL had the most effective control of 96,4% with PVY; TMV: 70,9%; CMV: 58,3%; and TNRV: 36,9%.

So, the effective control of Ditacin 8SL with TMV, CMV, PVY, and TMRV was better than Sat 4SL in the experimental field condition in the spring of 2020 in Bac Giang province.

**Table no 3:** Effective control of Ditacin 8SL, Sat 4SL with TMV, CMV, PVY, and TNRV in the field in Bac Giang province, Vietnam

| Treatment | Target surveillance | Ditacin 8SL | Sat 4SL | Control |
|---|---|---|---|---|
| TMV | Disease incidence (%) | 0,0 | 0,24 | 1,76 |
| | DI (%) | 0,0 | $0,23^{b}$ | $0,79^{a}$ |
| | EC (%) | 100 | 70,9 | - |
| CMV | Disease incidence (%) | 9,7 | 10,0 | 21,1 |
| | DI (%) | $6,9^{b}$ | $7,3^{b}$ | $17,5^{a}$ |
| | EC (%) | 60,5 | 58,3 | - |
| PVY | Disease incidence (%) | 0,23 | 0,12 | 2,3 |
| | DI (%) | $0,09^{b}$ | $0,05^{b}$ | $1,4^{a}$ |
| | EC (%) | 93,6 | 96,4 | - |
| TNRV | Disease incidence (%) | 31,5 | 43,4 | 58,2 |
| | DI (%) | $23,9^{c}$ | $31,4^{b}$ | $49,8^{a}$ |
| | EC (%) | 52,1 | 36,9 | - |

*Note: Surveying disease incidence and Disease index in the stage April 1, 2020. CV%: DI of TMV: 15,58; CMV: 12,8; PVY: 12,3, and TNRV: 9,6. Velue preperation of Turkey: TMV: 0,27; CMV:5,7; PVY: 0,23; and TNRV: 6,4.*

***Yield and grade***

*Fresh and dry yield*: The sprayed treatments by Ditacin 8SL, the yield of fresh leaves reached 14,1 tons/ha, higher than 25,5% comparing control treatment (Table 4). For Sat 4SL, the yield of fresh leaves was 12,9 tons/ha and higher than 18,6% comparing the control treatment. Similar to fresh yield, the dry yield of Ditacin 8SL and Sat 4SL were corresponding to 1,5 tons/ha and 1,3 tons/ha, higher than 40% and 30,8% comparing control treatment.

*Curing leaves grade*: The spraying treatment had higher curing leaf grade than no spraying treatment. For example, the spraying by Ditacin 8SL and Sat 4SL, grade 1 + 2 of curing leaves reached from 56,3% to 57,1% and compared to control: 38,3%; Grade 3 reached from 32,6% to 35,3% and Control: 26,1%. Grade 4 of spraying treatment only reached 7,7 - 11,2% and compared to control reaching 35,6%. The rate of grade 4 was high that reduced the useful value and economic value of dry leaf products.

**Table no 4:** Effective control of Ditacin 8SL, Sat 4SL with TMV, CMV, PVY, and TNRV impacted theyield and curing leaves grade

| Treatment | Fresh yield (Tons/ha) | % increasing Fresh yield with control | Dry yield (Tons/ha) | % increasing Fresh yield with control | Curing leaves grade (%) | | |
|---|---|---|---|---|---|---|---|
| | | | | | 1 + 2 | 3 | 4 |
| Ditacin 8SL | 14,1[a] | 25,5 | 1,5[a] | 40,0 | 57,1 | 35,3 | 7,7 |
| Sat 4SL | 12,9[ab] | 18,6 | 1,3[ab] | 30,8 | 56,3 | 32,6 | 11,2 |
| Control | 10,5[b] | - | 0,9[b] | - | 38,3 | 26,1 | 35,6 |

***The effective control of Ditacin 8SL, Sat 4SL with the viral diseases impacted the yield and quality of tobacco***

*Chemical components*: For the treated tobacco plants by virucides, nicotine and sugar content increased slightly compared to the control treatment. Details of the nicotine content of treating by Dtacin 8SL and Sat 4SL ranged from 1,79 - 1,81% and compared to control of 1,7%; and the sugar content ranging from 10,5 to 11,1% and the control: 9,7%.

*Smoke sensory properties*: The content of nicotine and sugar was not much different between the two experimental treatments leading to smoke properties of them being similar. For example, the point of the aroma and taste of sprayed tobacco ranged from 9,1 – 9,3 points and similar to control. Those virucides which were sprayed on tobacco in the stage from 3 – 4 leaves to 16 – 18 leaves with 6 spraying times did not impact on aroma and taste of tobacco. The total of smoke reached arranging from 38,7 to 39,4 points and a pretty good level.

**Table no 5:** Chemical components and smoke sensory properties of tobacco experiment

| Treatment | Chemical components (%) | | Smoke sensory properties (points) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Nicotine | Sugar | Aroma | Taste | Smoke strength | Burning rate | Colour of fibers | Total points |
| Ditacin 8SL | 1,81 | 11,1 | 9,1 | 9,1 | 7,0 | 7,0 | 6,5 | 38,7 |
| Sat 4SL | 1,79 | 10,5 | 9,3 | 9,1 | 7,0 | 7,0 | 7,0 | 39,4 |
| Control | 1,70 | 9,7 | 9,2 | 9,1 | 7,0 | 7,0 | 6,5 | 38,8 |

## IV. Discussion

Treating the active ingredients of Ningnanmycin and Cytosinpeptidemycin did not prevent all viruses of TMV, CMV, and PVY that infecting the plants and lead to infected plants with a rate of 100% after 10 days of inoculation. However, they were able to limit and prevent the growth and spread of viruses in tobacco, from inoculative leaves to other leaves. The young leaves were hidden symptoms or lighter symptoms than the inoculative leaves. A result showed Ningnanmycin and Cytosinpeptidemycin increased the resistance of tobacco plants with TMV, CMV, and PVY.

Increasing spraying times in the period from 3 - 4 leaves/plant to 16 - 18 leaves/plant increased the resistance of tobacco plants with virus diseases. The effective control was the best when spraying virucides before the tobacco was contaminated, and reduced following the severe index of the infective plant. The spraying of virucides was not effective when the tobacco plants were injured severely. Because treating NNM on tobacco plants increased rubisco enzyme content, reduces the harm of virus to photosynthesis by inhibiting the numbers of TMV-CP in the chloroplast, preventing progress assembly of CP, and multiplying of the virus in the plant leads to decrease viral disease symptoms on the host plant. Besides, treating Ningnanmycin also increased enzyme β-1,3-glucanases content, the action of some phenylalanine ammonia-lyase, peroxidase, and superoxide dismutase, and increased resistance of crops, limited the infection and development of the virus in the crops. All tobacco plants that were sprayed NNM raised strongly salicylic acid content in the crops. SA was an antibiotic under the action of NNM on the plant's resistance gene, had the effect of triggering a self-defense reaction, inhibited and isolated the virus at the site of infection by creating the necrotic spots to prevent the growth and spread of the virus.SA effectively inhibited the site of infection for the disease of TMV. For CMV. SA did not inhibit CMV at the site of infection but limited the movement of the virus from the infected leaf to another leaf. This leads to a gradual decrease in the symptoms of the leaves were developed after (Alex M. Murphy et al. 2002). Spraying salicylic acid with a dose of 1% on potato plants before the plant was infected or symptoms of Potato virus Y (PVY) did not appear to give the best antiviral results, and there was no preventive effect when symptoms appeared severely (Zainab F. Al-Hashimi. 2010). For Cytosinpeptidemycin, it had effective control of a lot of viral diseases on many crops such as rice, papaya, and tobacco. It could prevent infected plants, prolonged incubation periods, destroyed viral structures, and reduced viral density in plants. Cytosinpeptidemycin reduced the active ability of the virus, protecting plants against virus

infection, slowed the appearance of symptoms on plants, reduced the level of damage on leaves, and stimulated plants to produce resistant proteins. Cytosinpeptidemycin affected the plant's antiviral gene, increases the enzymatic activities of peroxidase (POD), superoxide dismutase (SOD), and catalase (CAT), and induced the plant's immune response of protein, mARN, and enzyme activities. CytPM could effectively delay the systemic infection of tobacco mosaic virus (TMV) in Nicotiana benthamiana and significantly inhibit the viral accumulation in tobacco (Mengnan An et al. 2019).

The results of the experiment in the spring of 2020 in Bac Giang province, Vietnam showed spraying Ditacin 8SL and Sat 4SL had the effective control of some virus diseases on tobacco such as TMV, CMV, PVY, and TNRV. To control viral diseases, had to spray the least from 3 to 6 times in the stage from 3 - 4 leaves/plant to 16 - 18 leaves/plant that depended on the field history. The spraying time was the best when tobacco plants were not infected or disease symptoms did not show on leaves. To increase the effective control of virus diseases, should spray mixing of the virucide and foliar fertilizer. Spraying cover all leaves of the plant. For CMV, PVY, and TNRV that were transmitted by vectors should add insecticides.

## V. Conclusion

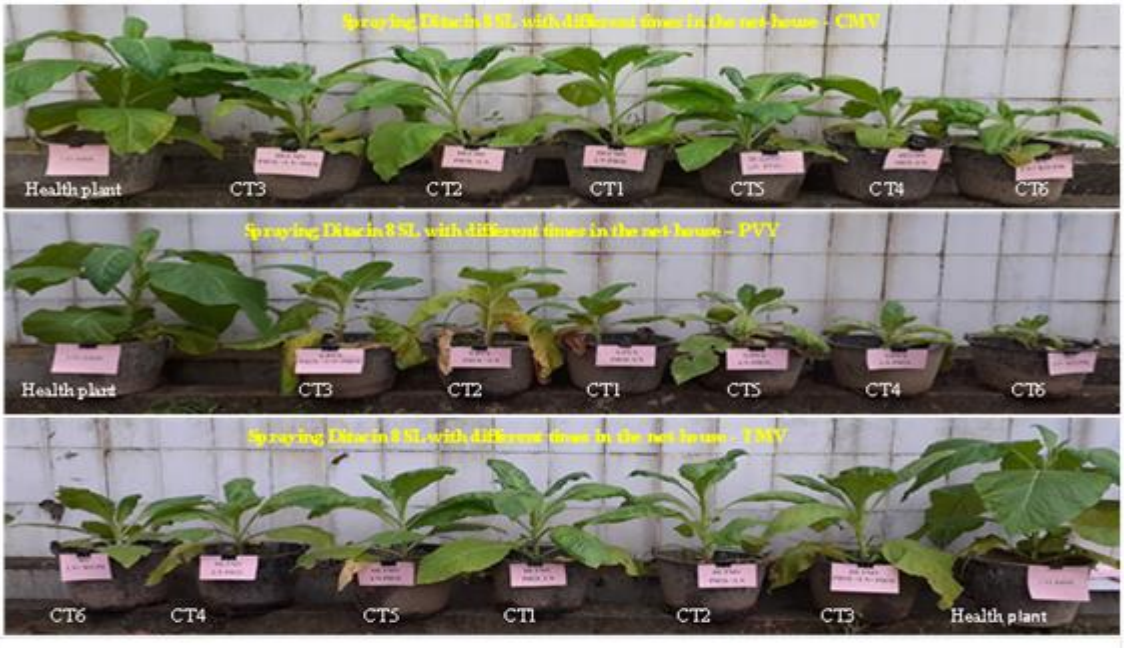


**Figure no 1:** Number of sprays and inoculative time with viral diseases on tobacco

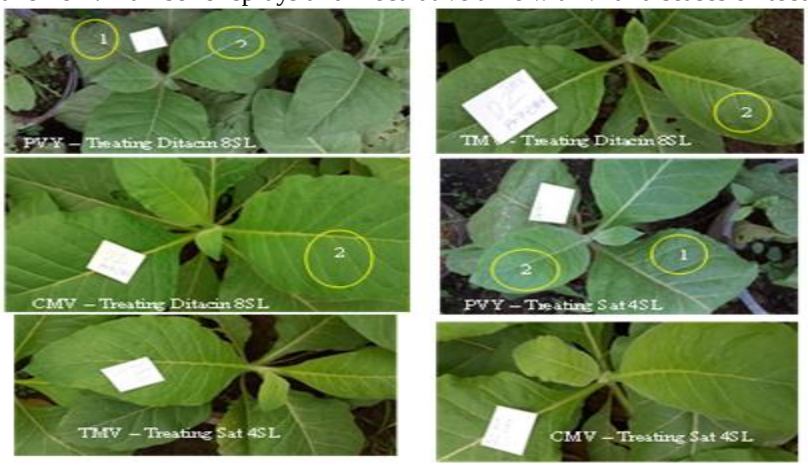


**Figure no 2:** Symptom disease after inoculation control: inoculation without spraying virucide, 1: inoculative leaves with serious symptom; 2: Young leaves without

The Ditacin 8SL (Ningnanmycin) and Sat 4SL (Cytosinpeptidemycin) were the effective control of TMV, CMV, PVY, and TNRV on tobacco plants. The spraying of virucide in the stage from 3 - 4 leaves to 16 - 18 leaves of tobacco plants with 3 - 6 times did not impact on aroma and taste of dry leaf tobacco. To increase the highest effective prevention of CMV, PVY, TNRV, have to spray mixing of virucide, insecticide, and foliar fertilizer; For TMV, it only uses the virucide and foliar fertilizer and destroys the infective plants after 3 days of spray.

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