

Management Of Apple Scab (*Venturia Inaequalis*) In Albania Based On Mills Table Warnings.

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Abstract:- The Fungus *Venturia Inaequalis* Infects Members Of The Maloideae, And Causes The Disease Apple Scab, The Most Important Disease Of Apple Worldwide. Apple Scab *Venturia Inaequalis* (Cke) Wint., Is A Major Problem In Albanian Apple Orchards And Is Responsible For Serious Economic Losses. The Purchase Of Spraying Equipment And Phytopharmaceutical Products Is Very Expensive In Comparison To The Income Of Local Apple Growers. In Several Apple Production Areas, Most Fungicide Sprays Applied To Orchards Target Apple Scab Management. This Is One Of The Reasons Why Reduced Fungicide Spraying Are Becoming More And More Important

The Experiment Is Carried Out At Qerret (Puka Region), During The Years 2010-2013 At The Islam Djaloshi Farm. The Experiment Is Set Up In Randomised Block Where The Main Effects Factor (Factor A Is The Cultivar) Are Seen In Two Levels (Cv. Starking And Golden Delicious). Second Factor (Application Time-The Factor B) In Two Levels (Taking In Consider Traditional Treatments And Table Of Mills). Third Factor (Fungicidal Treatment – The Factor C) In Four Levels (1. Amicarb 100; 2. Kresoxim – Metil; 3. Pencozeb DG; 4. Control.

Analysing The Data, On Average, The Treatments Done In Plot 1 Caused About 50% Less Damage Than The Traditional Spraying. This Indicated That With A Relative Small Amount Of Well Timed Spraying A Enormous Amount Of Damage Can Be Prevented. A Mills Table Warnings Calendar-Based Management Program Seems To Be Less Effective (More Spraying Needed And The Results Are Worse). These Results Also Emphasize The Importance Of The Development Of An Adequate Apple Scab Management Program That Should Be Presented To Local Apple Growers.

Keywords:- Alternative Fungicides, Armicarb, Organic Production, Small Fruits, Efficacy

I. INTRODUCTION

Apple Scab Exists Worldwide But Is More Severe In Areas With Cool, Moist Springs And Summers. In The United States It Is Most Serious In The North Central And Northeastern States. Similar Scab Diseases Affect Pears (*V. Pyrina*) And Hawthorns (*V. Inaequalis* Sp.F. *Pyraacanthae*). (G.N.Agrios. 2005).

Apple Tree Is One Of The Most Importance Fruit Tree And At Least 55 Million Ton Has Been The Yield Of Apple In The World, With A Value By 10 Milliard Dollars For The Year 2005. Between The Countries, USA Are The First One With 7.5 % Of The World Apple Production Turkey, France, Italia, Iran Are The Most Importance Apple Production Exporter In The World (FAO 2008). Scab Is The Most Important Disease Of Apples. Its Primary Effect Is Reduction Of The Quality Of Infected Fruit. Scab Also Reduces Fruit Size Or Results In Premature Fruit Drop, Defoliation, And Poor Fruit Bud Development For The Next Year, And It Reduces The Length Of Time Infected Fruit Can Be Kept In Storage. Losses From Apple Scab May Be 70% Or More Of The Total Fruit Value. In Most Apple-Producing Areas, No Marketable Fruit Can Be Harvested If Scab Control Measures Are Not Taken. (G.N.Agrios. 2005).

In Puka Region, Comparing With The Other Fruit Trees, Apple Tree Is The Most Importance. Based On The Data Of Regional Directorate Of Agriculture, Food And Consumer Protection In Albania In This Region Are Planted 16800 Apple Trees. In Blokes There Are About 122 Ha With 9400 Plants. The Most Importance Apple Varieties Are Golden Delicious, Starking, Jonathan, Idaret, Rennet, Granysmith Etc. In Fruit Trees, Besides Of Other Problems, Plants Protection Is The Main, Especially In The Apple Tree, Because Of It Can Be Infected By Many Diseases Such Are Apple Scab, Powdery Mildew, Fire Blight, As Well As By Codling Moth, Aphids, Mites. (Hasani.M 2008)

Since The Early 1990s, Considerable Progress Has Been Made In Developing Simple Or Computerized Apple Scab Prediction Systems Of Spore Release And Infection For Scheduling Fungicide Applications For Scab Control. (Palmer, C.L., Horst, R.K. & Langhans, R.W. (1997). All The Systems Are Based On The

Interactions Among Temperature, Amount And Duration Of Rainfall, And Duration Of Leaf Wetness, On The One Hand, And The Period Required For The Pathogen To Initiate Infection On The Other. The Accuracy And Dependability Of These Models Vary Considerably Under Different Local Conditions.

II. MATERIAL AND METHODS

2.1. Experimental Field

The Experiment Is Carried Out At Qerret (Puka Region), During The Years 2010-2013 At The Islam Djaloshi Farm. The Super Faces Of The Parcel Were 2.6 Ha. The Distance From The City Of Puka Is 5 Km And The Distance From The Main Axe Of The Road Is 1.8 Km. The Parcel Is At These Geographic Coordinates: 42° 07' 03'' Nord And 19° 49' 36'' East As Well As 465 M Above The Level Sea. Average Annual Temperatures Are From 2.8° C On January At 17.7° C On June.

The Experiment Is Set Up In Randomised Block Where The Main Effects Factor (Factor A Is The Cultivar) Are Seen In Two Levels (Cv. Starking And Golden Delicious). Second Factor (Application Time- The Factor B) In Two Levels (Taking In Consider Traditional Treatments And Table Of Mills). Third Factor (Fungicidal Treatment – The Factor C) In Four Levels (1. Amicarb 100; 2. Kresoxim – Metil; 3. Pencozeb DG; 4. Control).

Two Cultivars Are Included In The Study; Starking And Golden Delicious. Data About The Fungicides Used Are In The Tab.1

Table. 1 Fungicides Used On Apple Scab (*Venturia Inaequalis*) Controlling

No	Commercial Name	Active Ingredient (%) And Manufacturer	Rate Of Application
1	Armicarb® 100	85% KHCO ₃ From Helena Chemical Company, USA	600gr/100 L
2	Kresoxim-Methyl (Stroby WG)	Methyl (E)-2-Methoxyimino-2-[2-(O-Tolyloxymethyl) Phenyl] Acetate. BASF, Belgium	250gr/100 L
3	Pencozeb DG	Etilenbisditioarbamat I Zinkut Dhe Magnezit From UNITED PHOSPHORUS LIMITED UK	250gr/100 L
4	Control	No Treatments	-

2.2. Scab Severity Assessment

Each Year, Disease Assessments On The Leaves And Fruits Were Made. For Leaf Severity Assessments, 10 Shoots Per Tree Were Recorded About 60 Days After Flowering. Observations Were Made On 10 Older Leaves Per Shoot. A 1-9 Global Scab Intensity Scale Was Used Whereby: 1 = No Scab Lesions; 2 = ≤ 1% Infected Leaves With At Least One Lesion; 3 = ≤ 5% Infected Leaves With At Least One Lesion; 4 = 5-50% Infected Leaves With At Least One Lesion; 5 = ≥ 50% Leaves With Lesions And With ≤ 5% Leaf Area Spotted; 6 = 5-25% Leaf Area Spotted; 7 = 25-50% Leaf Area Spotted; 8 = 50-75% Leaf Area Spotted; And 9 = Maximum Infections, Leaves Black With Scab⁵

Severity And Diffusion Of Infection Were Obtained By Resorting To The Mckinney Index (H.H.Mckinney 1923) Modified From Cooke, B. M. (B.M. Cooke 2006). The Mckinney Index (Imc) Was Obtained By Using The Following Formula:

$$DI (Imc) \% = \frac{\sum (f \times v)}{N \times X} \times 100$$

Where: F = Infection Class Frequencies; V = Number Of Plants Of Each Class; N = Total Of Observed Plants; X = Highest Value Of The Evaluation Scale.

2.3. Statistical Analyse Of The Data

For All The Experiment Data Variance Analyse (ANOVA) Is Used. Three Factorial Analyse Is Done Using Statistical Programme ASSISTAT (2014) – Website Http://Www.Assistat .Com By Francisco De A.S. E Silva DEAG-CTRN-UFC (Assistat 2014)

Comparisons Of Averages Of The Disease Index With Control Plot (Without Treatment) Is Done Using Tukey Kramer⁹ For Two Levels Of Probability P=0.05 And P= 0.001. For This Aim Statistical Program SAS 2009 Is Used (SAS 2009)

III. RESULTS AND DISCUSSIONS

3.1 Results about Disease Index

Data About Disease Index For The Three Years (2011-2012-2013) Are Presented At Table 2. The Data On The Table 2 Show That At The Tradicional Treatment, For The Cv. Starking, Disease Index (%) Was From 22.69 % At The Plot Treated With Armicarb To 17.26 % At The Plot Treated With Kresoxim-Methyl. At The Plot Treated With Pencozeb Disease Index Was 12.17 % While At The Control Plot It Was 50.66 %. For The Golden Delicious Cultivar Disease Index Was 22.49 % At The Plot Treated With Armicarb While At The Plot Treated With Kresoxim-Methyl It Was 17.26% And 12.55 %. At The Plot Which Was Treated With Pencozeb Disease Index Was 12.17 % While At The Control It Was 45.48 %. Looking On The Table.2, For The Treatments By Means Of The Mills Prediction Table Also For The Three Years (2011-2012-2013), Disease Index For Starking Cultivar At The Plot Treated With Armicarb Was 17.12%, While It Was 9.66 % At The Plot Treated With Kresixim –Methyl. At The Plot Treated With Pencozeb, Disease Index Was 11.75 % While At Control It Was 50.66 %. For The Golden Delicious Cultivar, Disease Index , At The Plot Treated With Armicarb Was 20.62 % While At The Plot Treated With Kresoxim –Methyl Was 9.66 %.

Differences Between Fungicides Treatments Used On Apple Scab Controlling For The Three Years (2011-2012-2013) Are At The Above Figure, Where For The Traditional Variant On Starking Cultivar Is Showed On The Left Of The Boksplots Diagram. Fungicides, Blue Rings, Have Significans Differences For The Propability P=0.05 (Tukey Kramer Test) And They Are Under The Average Value, In Our Case It Is 21.4%.

Similar Differences, Between Fungicides Treatments On Apple Scab Controlling For Golden Delicious Cultivar Is Shoed On The Right Of The Above Diagram. Fungicides (Kresoxim-Methyl, Pencozeb And Armicarb), Blue Rings, Have Statistical Significant Differences (Tukey Kramer Test) For A Propability By 22.30 %. Differences Between Fungicides Treatments Used On Apple Scab Controlling By Means Of Table Of Mills, For The Three Years (2011-2012-2013), At Starking Cultivar, Are On The Figure 2.

On The Left Of The Above Diagram, Used Fungicides, Blue Rings, Have Statistical Significant Differences For The Level Of The Propability 0.05 (Tukey Kramer Test) Whish Are Under The General Average Value, 22.49%.

Similar Differences Between The Fungicidal Treatments Used For Apple Scab Controlling At The Golden Delicious Cultivar Can Be Seen On The Right Of The Above Diagram (Fig 3). Fungicides (Kresoxim – Methyl, Pencozeb And Armicarb), Blue Rings, Have Statistical Significant Differences For The Propability 0.05 % (Tukey Kramer Test) Which Are Under The General Average Value, 21.75 %.

Table. 2 Disease Index (%) On Leave Caused By *V. Inaequalis* (Cook) Wint For The Three Years (2011-2012-2013)

Cultivars Factori (A)	TREATMENT Factori (C)	TIME OF TREATMENT Factori (B)									
		MEANS TRADICIONAL TREATMENT Imc In %					MEANS OF MILLS TABLE TREATMENT. Imc- In %				
		2011	2012	2013	Σ	Averag e	2011	2012	2013	Σ	Averag e
Starking	Armicarb® 100	15.8	18.5	17.5	51.8	17.26 B	16.7 5	17.5	17.1 2	51.37	17.12 C
	Kresoxim- Methyl	9.8	11.5	10.7 5	32.0 5	10.68 C	8.75	9.75	10.5	29	9.66 B
	Pencozeb DG	11.4	13.12	12	36.5 2	12.17 C	11.2 5	12.5	11.5	35.25	11.75 B
	Control	49	52.5	50.5	152	50.66 A*	49	52.5	50.5	152	50.66 A
	Σ(Sum)	86	95.62	90.7 5	272. 3	-	85.7	92.2	89.6	267.6 2	-
	Average	21.5	23.90	22.6 8		22.69	21.4	23.1	22.4		22.30
		Lsd** =3.20234 For @=0.05 %					Lsd** =3.20234 For @=0.05 %				
Golden Delicious.	Armicarb® 100	20.75	22.25	21.25	64.2	21.41 B	20	21.25	20.6 2	61.87	20.62 B
	Kresoxim- Methyl	9.3	10.87	11.4	31.5	10.52 C	9.5	9.5	9.75	28.75	9.58 C

Pencozeb DG	11.75	13.9	12	37.6	12.55 C	11.25	11.62	11.12	33.99	11.33 C
Control	44.5	48.25	43.7	136.	45.48 A	44.5	48.25	43.7	136.45	45.48 A
∑(Sum)	86.3	95.2	88.35	269.	-	85.2	90.6	85.1	261.06	-
Average	21.57	23.8	22.08		22.49	21.3	22.6	21.2		21.75
	Lsd** =3.20234 For @=0.05 %					Lsd** =3.20234 For @=0.05 %				

* A = Levels Not Connected By Same Letter Are Significantly Different **Lsd = Significative Minimum Difference The Tukey Test At A Level Of 5% Of Probability

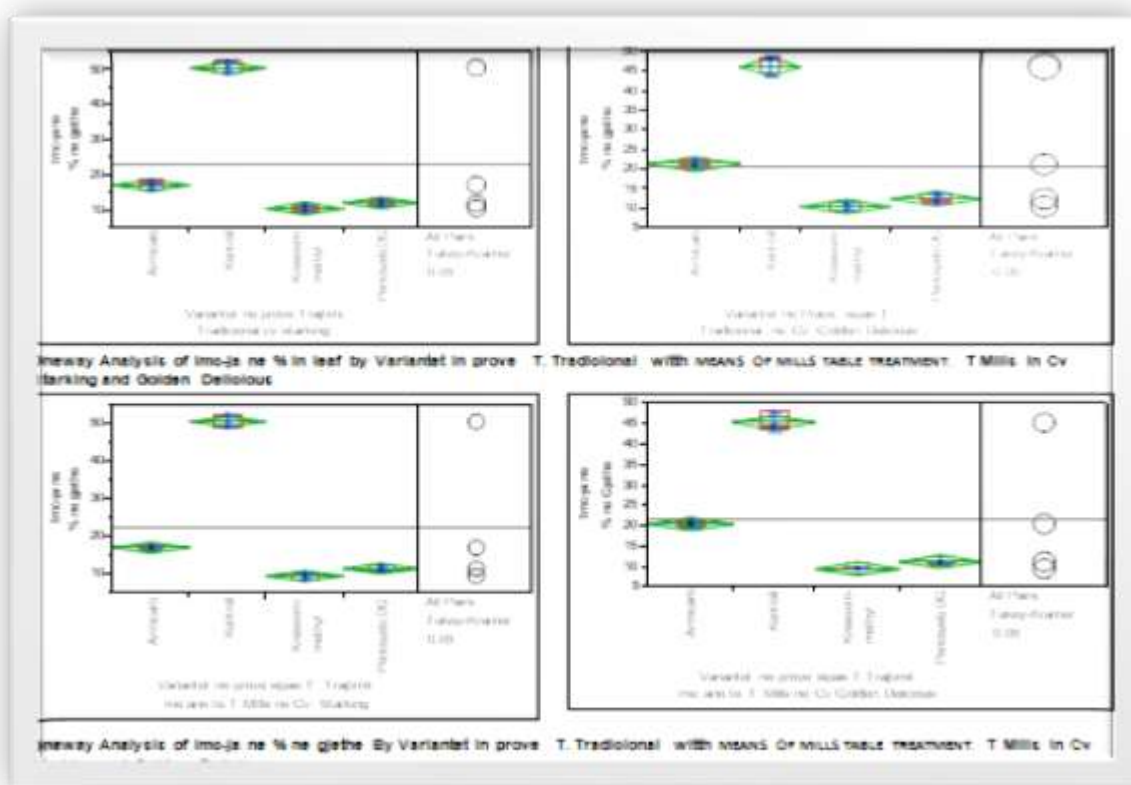


Figure. 2 The Diagram Of Boxplots (Variance, Standart Deviation, Average Of Disease Index) Of Apple Scab On Leave For The Three Year (2011-2012-2013)

Using Statistical Program ASSISSTAT (2014) ASSISTAT Version 7.7 Beta (2014) - Website <http://www.assistat.com> By Francisco De A. S. E Silva DEAG-CTRN-UFCG Updated On 09/27/2014 There Are The Results Of The Three Factorial Analyse For The Three Factors On The Study: Cultivars At Two Levels (Cv. Starking And Cv. Golden Delicious), Time Of The Treatments (Tradicional Treatments And By Means Of Table Of Mills), And Fungicides Treatments At Four Levels. These Data Are Shown At The Above Table. From These Data It Can Be Concluded That The Effects Of The Fungicide Factor Statistically Significant For The Level $P \leq 0.001$. This Is Proved From The Factic Value “F” For The Fungicides =2261.263 **Which Results To Be Higher Than Teoric Value “F” Taking In Consider Fisher Table, Where 2261.263 Is More Than 4.4604 For The Level < 0.001 . Also For The Propability Level By 0.05 Is Statistical Significant The Interaction Effect Of Cultivar X Fungicide (Bxc) As Well As Interaction Axbxc. Taking In Consider That The Fungicides Effect As Well As Interaction Bxc (Treatment Time X Fungicide) And Axbxc Are Significant, It Means Different Effect Of The Fungicides For Cv. Starking And Cv. Golden Delicious Cultivar As Well As Treatment Method Tradicional Treatment And By Means Of Mills Table.

Table. 3 Three Factorial Analyse (MANOVA) On Apple Scab Index Disease (%)For The Three Year (2011-2012-2013)

VS	DF	SS	MS	F	Probability
Cultivars A	1	1.65392	1.65392	1.0054 Ns	0.3234
Time Treatments B	1	3.91592	3.91592	2.3805 Ns	0.1325
Treatments (Fungicides) C	3	11159.263	3719.75464	2261.263 **	<.0001
Interactions Axb	1	0.36925	0.36925	0.2245 Ns	0.6387
Interactions Axc	3	123.78577	41.26192	25.0834 **	<.0001
Interactions Bxc	3	1.60607	0.53536	0.3254 Ns	0.807
Interactions Axbxc	3	0.43787	0.14596	0.0887 Ns	0.9657
Total	15	11291.03271	752.73551	457.5929 **	<.0001
Error	32	52.6396	1.64499		
Total VS	47	11343.67			

** Significant At A Level Of 1% Of Probability ($P < .01$) * Significant At A Level Of 5% Of Probability ($.01 \leq P < .05$) Ns Non-Significant ($P \geq .05$) VS = Variation Souce, DF = Degree Of Freedom, SS = Square Sum, MS = Mean Square, F = Statistics Of The Test.

IV. CONCLUSIONS

The Data Of The Experiment We Are Studying Bring The Effects Of Two Factors, Cultivars At Two Levels (Cv. Starking And Cv. Golden Delicious), Time Of The Treatments (Tradicional Treatments And By Means Of Table Of Mills), And Fungicides Treatments At Four Levels. These Data Are Showed At The Above Table.

- 1- From These Data It Can Be Concluded That The Effects Of The Fungicide Factor Statistically Significant For The Level $P \leq 0.001$. This Is Proved From The Factic Value " F " For The Fungicides =2261.263 Which Results To Be Higher Than Teoric Value "F" Taking In Consider Fisher Table, Where 2261.263 Is More Than 4.4604 For The Level < 0.001 .
- 2- Also For The Propability Level By 0.05 Is Statistical Significant The Interaction Effect Of Cultivar X Fungicide (Bxc) As Well As Interaction Axbxc.
- 3- Taking In Consider That The Fungicides Effect As Well As Interaction Bxc (Treatment Time X Fungicide) And Axbxc Are Significant, It Means Different Effect Of The Fungicides For Cv. Starking And Cv. Golden Delicious Cultivar As Well As Treatment Method Tradicional Treatment And By Means Of Mills Table.
- 4- From The Results Obtained For 2012 It Appears That Fungicide As (Kresoxim-Methyl And DG Pencozeb Give Good Results Against Apple Scab (*Venturia Inaequalis* (Cooke) Wint) By Applying The Method SIPA Treatment Session Mills.
- 5- The Result Has Given Bio Fungicidi As Armicarb ® 100 (85% KHCO₃ From Helena Chemical Company Which Is Able To Control Better Apple Scab (*Venturia Inaequalis* (Cooke)

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