Republic of the Philippines
DEPARTMENT OF AGRICULTURE
NATIONAL TOBACCO ADMINISTRATION
Scout Reyes Street, corner Panay Avenue, Quezon City
Tel. No. (02) 374-3987 Fax No. (02) 374-2505

CERTIFICATE OF PRODUCT EFFICACY AND SUITABILITY

This is to certify that **Hyper Plus Foliar Fertilizer**, **Endoroots** and **Solubor**, manufactured and distributed by **MJ Multilines, Inc.**, with principal office address at 291 P. Guevarra Street, San Juan, Metro Manila, Philippines, has satisfactorily passed a Bioefficacy Evaluation Trial entitled "**Verification Trial of Hyfer Plus Foliar Fertilizer, Endoroots and Solubor on the Growth, Yield and Quality of Tobacco**", conducted by the National Tobacco Administration under its Protocol Research and Development Program, Crop Year 2013-2014.

Issued this 15th day of October 2014, in Quezon City, Philippines.

Project Evaluation Committee:

REX ANTONIO P. TEOXON
Chairman

ROBERTO R. BONOAN, Ph.D.
Member

DINAH E. PICHAY
Member

MA. TERESA B. LAUDENCIA
Member

Approved:

EDGARDO D. ZARAGOZA, *CPA, MBA*
Administrator

Verification Trial of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor on the Growth, Yield and Quality of Tobacco

Inocente PA., WV. Oribello, MP Galaraga, AS Malab, AL Tumbaga,
RJ Raganit Jr., LR Truong and RR Bonoan

ABSTRACT

The project aimed to evaluate the effectiveness of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor on the growth, yield and quality of tobacco; to compare the effect of the recommended package of technology using Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor with the farmer's fertilization practice and to generate data to support product registration of the new products with Fertilizer and Pesticide Authority (FPA).

The verification trials were conducted in San Fernando, La Union for Virginia Neutral tobacco, Alcala, Pangasinan for Burley Neutral tobacco and Tuguegarao, Cagayan for Native Cigar filler tobacco. The farmer cooperators applied 100% of the NTA recommended fertilizer rate plus the application of endoROOTS and Hyfer Plus Foliar Fertilizer, on the seedbed and Hyfer Plus Foliar Fertilizer and Solubor in the field at the recommended rates and application time. This was compared to the control treatment wherein the farmers used 100% of the NTA recommended fertilizer rate only. However, the Tuguegarao Branch Manager and staff assigned in the project tested several rates by using 1) the recommended fertilizer (RF) rates (100%) with the application of the products at recommended rates, 2) 75% of the RF plus the application of the products, 3) 75% of the RF and products + additional 21-0-0 fertilizer and 4) the farmers practice (100% of the RF) with no additional products.

Results showed that application of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor to Virginia and Burley neutral flavor tobacco increased plant height, number of harvestable leaves and significantly longer and wider leaves which consequently increased cured leaf yield. Higher percentage of high grade leaves of Virginia and Burley neutral flavor tobacco was also produced.

For cigar filler tobacco, seedlings applied with Hyfer Plus Foliar Fertilizer and endoROOTS had longer roots than seedlings taken from the farmers practice. However, the seedling height and number of leaves produced was similar. For the transplants in the field, the application of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor with 75% of the recommended rate of fertilizer increased the yield, crop value and net income. Further addition of nitrogen fertilizer (21-0-0) however, gave the highest yield per hectare and crop value brought about by the higher percentage of high quality leaves. Cigar filler tobacco (Tabije) was profitable when applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor even with only 75% of the recommended fertilizer rate plus additional 21-0-0. However, results may vary if the plants were provided with sufficient water at the later growth stages which was not supplied due to drought.

VERIFICATION TRIAL OF HYFER PLUS FOLIAR FERTILIZER, ENDOROOTS AND SOLUBOR ON THE GROWTH, YIELD AND QUALITY OF TOBACCO

INTRODUCTION

Like the other high value crops, tobacco (*Nicotiana tabacum L.)* requires a balanced proportion of the major and minor elements for proper nutrition. Considered a nutrient exacting crop, tobacco needs moderate to high amounts of nitrogen, moderate amount of phosphorus and liberal amounts of potassium for better leaf quality. Aside from the major elements, it also requires the secondary elements like calcium, magnesium, manganese and sodium and some micronutrients like boron, copper, iron and zinc especially in micronutrient deficient paddy areas. Leaf quality which dictates the economic value of tobacco whether for local cigarette manufacturing or for export should be given attention by providing to the plant the needed elements for proper nutrition.

At present, chemical fertilizers containing the three (3) major elements – nitrogen, Phosphorus and potassium are commonly used in tobacco production. There are still very limited fertilizer grades that contain both the major and minor elements used in tobacco production.

This verification trial will therefore determine the effects of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor on the growth, yield and quality of the three (3) tobacco types namely; Virginia, Burley and Native.

OBJECTIVES

1. To evaluate the effectiveness of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor on the growth, yield and quality of tobacco;

2. To compare the effect of the recommended package of technology using Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor with the farmer's fertilization practice;

3. To generate data to support product registration of the new products with the Fertilizer and Pesticide Authority (FPA).

METHODOLOGY

Description of the Products

Hyfer Plus Foliar Fertilizer (HPFF) is a unique blend of properly balanced essential Macro and Micro nutrients (Nitrogen, Phosphorus, Potassium, Boron, Copper, Calcium, Iron, Magnesium, Manganese, Molybdenum, Sodium, Sulfur and Zinc) amino acid, humic acid, vitamins hormones, and spreader/sticker. It is primarily used for leafy vegetables during the vegetative stage of the plant. It stimulates better photosynthetic activity of the leaves and nutrient absorption of the roots. It is generally recommended for use as a nutritional supplement in early plant stages. *The recommended dosage is 60 ml. to 100 ml. per 16 L of water.*

endoROOTS (ER) is a blend of different species of Mycorrhiza, humic acid, amino acid, vitamins and cold water kelp extract. It is 100% technical grade with the following benefits; 1) Mobilizes nutrient uptake and utilization; 2) Promotes rapid root and shoot growth; 3) Quicker establishment of seedlings, cuttings and transplant; 4) Enhances crop yield and quality and 5) Provides protection against common soil borne diseases such as nematodes. *The recommended dosage was 1 gram per 1 L of water*

Solubor (SB) is a special sprayed dried and complex sodium borate product. It is the highest concentrated boron foliar fertilizer (20.9%) in the market. It is readily soluble even in cold water. Once dissolved, it remains as a uniform concentration of boron solution unlike others which recrystallize. It can be mixed with most agricultural chemicals inclusive of pesticides for a one-off operation. *The recommended dosage: is 1.5 to 2 grams per 1 L of water.*

The verification trials were conducted in San Fernando, La Union for Virginia Neutral tobacco, Alcala, Pangasinan for Burley Neutral tobacco and Tuguegarao, Cagayan for Native Cigar filler tobacco.

Experimental Treatments

1. Control – the recommended fertilizer rate in bags per hectare without application of any of the products (Farmers Practice).

   The following were the tobacco types and locations to which the project was conducted and the kind and amount of fertilizers used by the farmer cooperators (control).

Tobacco Type	Location/ Barangay	Kind of Fertilizer, Rate per Ha.	
		NPK/ha	Sources & Amount of Fertilizer
Virginia Neutral	San Fernando, La Union	46-37.5-50 kg	5 bags 10-15-20 2 bags 21-0-0
Burley Neutral	Alcala, Pangasinan	175-36-48 kg	4 bags of 10-18-24 2 bags of 0-0-50+ 6 bags of 21-0-0 + 4 bags of 46-0-0
Cigar Filler	Tuguegarao, Cagayan	41-25-37.5 kg	2.5 bags of 16-20-0 2 bags of 21-0-0 + 1.5 bags of 0-0-50+ 7 kg of Biozome

2. NTA Fertilizer Recommended Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor

TREATMENT APPLICATION in the seedbed

Application Schedule	Solution/Mixture Ratio	Application Method	Rate/Vol.of Appl'n / ha.
1st- 14 DAE	50 ml HPFF/16 li water	Sprayed on beds	50 ml HPFF
2nd- 21 DAE	50 ml HPFF+16 g ER /16 li water	Sprayed on beds	50 ml HPFF 16 g ER
3rd – 5 DBT	50 ml HPFF+16 g ER + 16 g SB /16 li water	Sprayed on beds	50 ml HPFF + 16g ER +16 g SB

HPFF – Hyfer Plus Foliar Fertilizer
ER – endoROOTS
SB – Solubor
DAE – Days After Emergence
DBT – Days Before Transplanting

TREATMENT APPLICATION in the field

Application Schedule	Solution/Mixture Ratio	Application Method	Rate/Vol.of Appl'n / ha.
Basal Fert.	Fertilizer recommendation (FR) + 50 g HFPP	Drilled at plant base	FR + 100g HPFF
1st – 7 DAT	75 ml HPFF + 16 g SB / 16 li water @ 200 L/ha spray volume	Sprayed on leaves	300 ml HPFF 64 g SB
2nd – 21 DAT	75 ml HPFF + 20 g SB / 16 li water @ 200 L/ha spray volume	Sprayed on leaves	300 ml HPFF 80 g SB
3rd – 35 DAT	100 ml HPFF/16 li water@ 200 L/ha spray volume	Sprayed on leaves	400 ml HPFF
4th (Last)–50 DAT	125 ml HPFF/16 li water @ 200 L/ha spray volume	Sprayed on leaves	500 ml HPFF

The Tuguegarao Branch Manager and staff assigned in the project tested several rates by using 1) the Recommended Fertilizer (RF) rates (100%) plus the application of HPFF, ER and SB, 2) 75% of the RF plus the application of HPFF, ER and SB at recommended rates, 3) 75%

of the RF + the application of HPFF, ER and SB at recommended rates + 21-0-0 fertilizer and 4) the farmers practice (100% of the RF) with no HPFF, ER and SB.

Data gathered:

A. Seedbed

1. Length of roots of seedlings – gathered at the pulling of seedlings by measuring the base of the roots up to the tip.
2. Height of seedlings - gathered at the pulling of seedlings by measuring the base of the seedling up to the tip of the longest leaf.
3. Number of leaves - gathered at the pulling of seedlings by counting the number of leaves produced by the plant including the buds with one-inch size.

B. Field

1. Plant height – gathered at 30 days after transplanting (initial) and after final harvest (final) taken on the 3rd leaf below the floral bud/inflorescence. Four sampling units with 30 sample plants per sampling unit were tagged. The same plants were used in the gathering of initial plant height, final plant height and leaf length and width of 10th leaf.
2. Leaf length and width of the 10th leaf was gathered one day before harvest.
3. No. of leaves per plant – gathered after the last harvest based on the leaf scar of the leaves.
4. Computed yield – This was derived on the total kilogram of tobacco delivered to the contract buyer of the farmer. Yield per hectare was computed based on the total plant population of the actual area of the farmer.
5. Grade/quality was based on the leaf grade distribution of the official grader of the buying firm.

Statistical Analysis

Data of the 30 sample plants which composed one sampling unit was averaged and the four sampling units represented the replications. This was analyzed using the analysis of variance. This was made only on plant height, leaf length and width and number of leaves. The yield and grade/leaf quality were not analyzed statistically because the actual total yield per treatment was taken as a whole.

RESULTS AND DISCUSSIONS

VIRGINIA NEUTRAL FLAVOR TOBACCO (GOLDEN HARVEST)

Growth and Yield Performance

Tobacco seedlings transplanted in the field had similar initial plant height but as they mature, the plants applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor were taller than the control (farmers' practice). However, the number of harvestable leaves was not affected by these applications (Table 1). Leaf expansion however, was significantly affected by the application of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor as shown by the longer and broader leaves. This implies that the application of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor was able to supply the needed micronutrients that hastened plant growth and leaf expansion. As reported by Sarhad (2008), micronutrients are essential for various enzymatic reactions and metabolic processes in plants.

The yield of Virginia neutral flavor tobacco (Golden Harvest) was higher by the use of NTA recommended fertilizer rate plus the application of Hyfer Plus Foliar Fertilizer, EndoROOTS and Solubor at recommended rates as shown in Table 1. It also had higher percentage of high quality leaf (79.1%) than those of the farmers' practice (32.0%).

Table 1. Agronomical characteristics, yield and leaf quality of Virginia Neutral Flavor Tobacco (Golden Harvest) as applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor. CY 2013-2014.

TREATMENTS	Plant Ht. (cm)		NHL	10th Leaf (cm)		Yield*	Quality (%)*	
	Initial	Final		Length	Width	Kg/ha	High	Low
NTA Recommended Fert. Rate + Hyfer Plus Foliar Fert., endoROOTS & Solubor	29.2	242.5	25.6	59.5 a	27.0	2113.0	79.1	20.9
Farmer' Practice	29.1	235.4	25.7	54.4 b	25.1	1928.4	32.0	68.0
Level of Sig.	ns	ns	ns	**	ns			
CV (%)	15.09	3.27	4.75	2.13	3.72			

Means followed by different letters within the same column are significantly different at 5 % probability level

NHL – Number of harvestable leaves High Quality – based on PhP 71-78 / kg
Low Quality – based on PhP 37-59/ kg
* Not subjected to statistical analysis

BURLEY NEUTRAL FLAVOR (NC 7)

Growth and Yield Performance

Table 2 shows the initial and final plant height, number of harvested leaves and leaf length and width of the 10th leaf of NC 7 as applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor. Significantly higher number of harvested leaves, longer and broader leaves was produced from plants applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor although plant height (initial and final) was not affected. Visual observations in the field indicated that plants sprayed with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor were not the usual very greenish plants that farmers are used to, since majority of the farmers apply high rates of nitrogen fertilizer.

Previously, the area used for this protocol research had several plants infected with fusarium wilt and plants showed boron deficiency symptoms. A noticeable number of plants affected with the disease (6%) maybe attributable to the seedlings which came from different who do not practice proper spraying management and fungicide application. Fortunately, one of the products (Solubor) is a special sprayed-dried and complex sodium borate which is the highest concentrated boron foliar fertilizer in the market. Boron deficiency was checked and the spread was controlled in the protocol site unlike the adjacent site which had more number of affected plants. Thus, harvested leaves on the affected plants were still long and of good quality.

According to Sarhad (2008), boron deficiency results in extreme turgidity and breakage of the midribs of leaves and also a rapid inhibition of plant growth. He also reported that Boron deficiency impairs normal cell elongation in growing plant tissues. High application of nitrogen and phosphorous fertilizers, introduction of high yielding varieties and intensive crop production systems may also induce the deficiencies of micronutrients.

The cured leaf yield and percentage of high, medium and low quality of Burley neutral flavour (NC 7) as applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor is shown in Table 3. The data indicates that plants applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor gave higher yield and higher percentage of high quality cured leaves. It was also observed that leaves of plants treated with the products upon harvest did not easily suffer from breakage such that sticking was easy because of its gumminess. During the curing period, there was uniformity in color hence, there was no need for longer conditioning prior to baling and marketing because as the leaf dries, its reddish color become more prominent. This is shown in the result of the marketing of the farmer cooperator of his tobacco wherein higher quality of the leaves was attained as compared to the cured leaves under the farmers' practice.

Table 2. Agronomical characteristics, yield and leaf quality of Burley neutral flavor (NC 7) as applied with Hyfer Foliar Fertilizer, endoROOTS and Solubor. CY 2013-2014.

TREATMENTS	Plant Ht. (cm)		No. of Harves-table Leaves	10th Leaf (cm)	
	Initial	Final		Length	Width
NTA Recommended Fert. Rate + Hyfer Plus Foliar Fert., endoROOTS & Solubor	11.9	162.1	31.1 a	47.9 a	27.0 a
Farmers' Practice	10.8	157.8	29.6 b	45.3 b	24.4 b
Level of Sig.	ns	ns	**	*	*
CV (%)	7.42	0.93	0.47	0.75	1.98

Means followed by different letters within the same column are significantly different at 5 % probability level

Table 3. Yield and leaf quality of Burley neutral flavour (NC 7) as applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor. CY 2013-2014.

TREATMENTS	Yield kg/ha	Leaf Quality (%)		
		High	Med	Low
NTA Recommended Fert. Rate + Hyfer Plus Foliar Fert., endoROOTS & Solubor	1952	20.6	59.7	19.7
Farmer' Practice	1,826.8	0.00	11.2	88.8

High Quality – based on PhP 71-78/ kg
Medium Quality – based on PhP 65-70/kg
Low Quality – based on PhP 64 & less /kg
* Not subjected to statistical analysis

CIGAR FILLER/NATIVE TOBACCO (TABIJE)

Seedling Production

Tabije tobacco seedlings were applied with Hyfer growth enhancer and endoROOTS and it was observed that the treated seedlings had longer roots (9.08 cm vs 4.25 cm) than control seedlings and denser internodes but were shorter in height (11.05 cm) than the seedlings from the farmers' practice (11.35 cm). However, the number of leaves per plants was similar (4 leaves) for both treated and untreated seedlings (farmers' practice).

Table 4. Agronomical characteristics of Cigar Filler/Native Tobacco (Tabije) seedlings produced when applied with endoROOTS. CY 2013-2014.

TREATMENT	Length of Roots (cm)	Height of Seedlings (cm)	Number of Leaves
Farmers' Practice (100% Buying Firm Recommended Fert. Rate)	4.25	11. 35	4
NTA Recommended Fert. Rate (100%) + Hyfer Plus Foliar Fert., endoROOTS & Solubor	9.08	11.05	4

Agronomic Performance in the Field

Seedlings treated with endoROOTS had longer roots and similar height as the seedlings produced under the farmers' practice. Initial plant height of Tabije seedlings varied (Table 5) and numerically shorter than seedlings taken from the farmers' practice. However, upon maturity, plant height of treated plants were numerically higher. Significant results were also observed on the number of harvested leaves and length of the 10th leaf. Plants applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor plus 75 % of the recommended rate of inorganic fertilizer produced numerically longer and more number of harvested leaves. However, addition of 21-0-0 did not further increase the length and number of harvested leaves. On the other hand, plants applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor plus 100% of the recommended rate of inorganic fertilizer produced shorter and lesser number of harvested leaves. These results maybe attributed to the scarcity of irrigation water starting at late vegetative stage of the plants. Although the farmer resorted to the "tabo-tabo system", still it was not enough to sustain the optimum water requirement of the plants.

According to Moore (2008), moisture levels should be maintained during the rapid growth stage (two feet high to early bloom). Leaf expansion and internode elongation are often severely restricted if adequate water in not available during this period. Water plays a very important role in the translocation of soil nutrients to all plant body parts.

Table 5. Agronomical characteristics of Cigar Filler/Native Tobacco (Tabije) as applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor. CY 2013-2014.

TREATMENT	Plant Ht. (cm)		NHL	10th Leaf (cm)		Stalk Length (cm)
	Initial	Final		Length	Width	
Farmers' Practice (100% NTA Recommended Fert. Rate)	24.7	137.3	21.2 b	71.6 b	35.4	62.4
NTA Recommended Fert. Rate (100%) + Hyfer Plus Foliar Fert., endoROOTS & Solubor	21.4	139.7	21.6 b	74.2 b	36.9	57.2
NTA Recommended Fert. Rate (75%) + Hyfer Plus Foliar Fert., endoROOTS & Solubor	23.7	149.0	24.0 a	79.9 a	39.8	54.1
NTA Recommended Fert. Rate (75%) + Hyfer Plus Foliar Fert., endoROOTS & Solubor + 21-0-0	23.3	148.5	24.2 a	78.3 a	38.2	55.2
Level of Significance	ns	ns	*	*	ns	ns
CV (%)	15.35	3.16	4.11	2.97	4.00	6.66

Means followed by different letters within the same column are significantly different at 5 % probability level using DMRT.

NHL – Number of Harvestable Leaves

Yield, Crop Value and Leaf Quality

Yield, crop value and percentages of high, medium and low leaf quality varied under the different treatments (Table 6). The highest yield and crop value was produced from plants applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor plus 75% of the inorganic fertilizer rate and further added with 21-0-0. The high crop value was brought about by the 12% high leaf quality wherein the other treatments had medium to low leaf quality. The lowest yield was produced from the control plants (farmers' practice with 100% recommended fertilizer rate). The plants treated with the products and applied with 100% recommended fertilizer rate had yield increased but the crop value was less under the farmers practice since lower quality of the leaves was produced (39.8 % vs 27.6%).

Table 6. Yield and leaf quality of Cigar Filler/Native Tobacco (Tabije) as applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor. CY 2013-2014.

TREATMENT	Yield	Crop Value	Leaf Quality (%)		
	kg/ha	PhP/ha	High	Med	Low
Farmers' Practice (100% NTA Recommended Fert. Rate)	2987.5	146,750.00	0.0	72.4	27.6
NTA Recommended Fert. Rate (100%) + Hyfer Plus Foliar Fert., EndoROOTS & Solubor	3093.8	145,819.00	0.0	60.2	39.8
NTA Recommended Fert. Rate (75%) + Hyfer Plus Foliar Fert., endoROOTS & Solubor	3,244.4	167,511.00	0.0	76.0	24.0
NTA Recommended Fert. Rate (75%) + Hyfer Plus Foliar Fert., endoROOTS & Solubor + 21-0-0	3,488.9	191,289.00	12.1	68.2	19.8

It was the general observation of the Branch Manager and Agriculturists that tobacco plants in Cagayan had yellowish leaves in the later part of the vegetative stage of the plants hence, the decision of including the application of additional nitrogen fertilizer (21-0-0) as one of the treatments. The result of these data proved that with 75% of the recommended fertilizer rate plus additional nitrogen fertilizer and application of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor, tobacco plants can give a gross income of PhP 191,289.00 with a difference of PhP 44,539.00 from the control (farmers practice).

Crop Profitability

The cost and return analysis of cigar filler tobacco applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor is shown in Table 7. Among the treatments, the most profitable tobacco was produced from plants applied with 75% recommended fertilizer rate, Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor and with additional nitrogen fertilizer (21-0-0).

Table 7. Cost and Return Analysis of Cigar Filler/Native Tobacco (Tabije) as applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor. CY 2013-2014.

TREATMENT	Crop Value	Total Cost of Prod'n	Net Income Above Cash Cost	Net Income Above Total Cost	ROI Above Cash Cost	ROI Above Total Cost
	PhP/ha	PhP/ha	PhP	PhP	%	%
Farmers' Practice (100% NTA Recommended Fert. Rate)	146,750	101,372	85,064	45,378	57.97	30.92
NTA Recommended Fert. Rate (100%) + Hyfer Plus Foliar Fert., endoROOTS & Solubor	145,819	106,391	79,639	39,427	54.62	27.04
NTA Recommended Fert. Rate (75%) + Hyfer Plus Foliar Fert., endoROOTS & Solubor	167,511	109,523	97,583	57,988	58.25	34.62
NTA Recommended Fert. Rate (75%) + Hyfer Plus Foliar Fert., endoROOTS & Solubor + 21-0-0	191,289	116,181	114,817	75,108	60.02	39.26

FRR – Fertilizer Recommended Rate (Inorganic fertilizer)

Its return on investment (ROI) above cash cost and above total cost was 60.02% and 39.26%, respectively. The high gross income (PhP 191,289.00) compensated for the high cost of production (PhP 116,181.00) which attributed to the highest net income above cash cost (PhP 114,817.00) and net income above total cost (PhP 75,108.00). The big difference in the total cost of production was accounted on the land owners' share which was 33% of the gross sales.

SUMMARY AND CONCLUSION

Generally, application of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor to Virginia and Burley neutral tobacco flavor increased plant height, number of harvestable leaves and significantly longer and wider leaves thereby increasing cured leaf yield. Higher percentage of high grade of Virginia and Burley neutral flavor was also observed.

For cigar filler tobacco, application of Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor with 75% of the recommended rate of fertilizer increased the yield, crop value and net income. Furthermore, addition of nitrogen fertilizer (21-0-0) further increased the yield per hectare, crop value brought about by the higher percentage of high quality leaves. Consequently, the cigar filler tobacco (Tabije) was profitable when applied with Hyfer Plus Foliar Fertilizer, endoROOTS and Solubor even though only 75% of the recommended fertilizer rate plus additional 21-0-0 was used. The results in Cagayan may differ if the plants were provided with sufficient water at the later growth stages which was not possible this cropping season due to drought.

APPENDIX TABLES

Appendix Table 1. Initial plant height (cm) of Virginia neutral flavor tobacco

Treatments	Replication				Total	Mean
	I	II	III	IV		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	33.7	34.9	24.0	24.3	116.9	29.2
Farmers' Practice (NTA Recommended Fertilizer Rate)	26.5	31.4	29.3	29.2	116.4	29.1
Total	60.2	66.3	53.3	53.5	233.3	29.2

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	3	57.82375	19.274583	1.00 ns	9.28	29.46
Treatment	1	0.03125	0.03125	0.00 ns	10.13	34.12
Error	3	58.06375	19.35458			
Total	7	115.91875				

CV (%) = 15.09

Appendix Table 2. Final plant height (cm) of Virginia neutral flavor tobacco

Treatments	Replication				Total	Mean
	I	II	III	IV		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	241.3	234.7	255.1	238.9	970.0	242.5
Farmers' Practice (NTA Recommended Fertilizer Rate)	219.1	236.7	246.7	239.2	941.7	235.4
Total	460.4	471.4	501.8	478.1	1911.7	239.0

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	3	459.87375	153.29125	2.50 ns	9.28	29.46
Treatment	1	100.11125	100.11125	1.64 ns	10.13	34.12
Error	3	183.63375	61.21125			
Total	7	743.61875				

CV (%) = 3.27

Appendix Table 3. Number of harvested leaves of Virginia neutral flavor tobacco

Treatments	Replication				Total	Mean
	I	II	III	IV		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	25.8	25.8	26.6	24.3	102.5	25.6
Farmers' Practice (NTA Recommended Fertilizer Rate)	27.0	24.8	24.8	26.1	102.7	25.7
Total	52.8	50.6	51.4	50.4	205.2	25.7

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	3	1.78000	0.59333	0.40 ns	9.28	29.46
Treatment	1	0.00500	0.00500	0.00 ns	10.13	34.12
Error	3	4.45500	1.48500			
Total	7	6.24000				

CV (%) = 4.75

Appendix Table 4. Leaf length of 10th leaf of Virginia neutral flavor tobacco

Treatments	Replication				Total	Mean
	I	II	III	IV		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	63.3	59.8	56.8	58.2	238.1	59.5
Farmers'Practice (NTA Recommended Fertilizer Rate)	56.1	54.6	53.8	53.2	217.7	54.4
Total	119.4	114.4	110.6	111.4	455.8	57.0

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	3	23.81500	7.93833	5.39 ns	9.28	29.46
Treatment	1	52.02000	52.0200	35.31 **	10.13	34.12
Error	3	4.42000	1.47333			
Total	7	80.25500				

CV (%) = 2.13

Appendix Table 5. Leaf width (cm) of 10th leaf of Virginia neutral flavor tobacco

Treatments	Replication				Total	Mean
	I	II	III	IV		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	29.9	27.3	25.8	24.8	107.8	27.0
Farmers' Practice (NTA Recommended Fertilizer Rate)	26.1	25.5	24.8	24.0	100.4	25.1
Total	56.0	52.8	50.6	48.8	208.2	26.0

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	3	14.41500	4.80500	5.12 ns	9.28	29.46
Treatment	1	6.84500	6.84500	7.29 ns	10.13	34.12
Error	3	2.81500	0.93833			
Total	7	24.07500				

CV (%) = 3.72

Appendix Table 6. Initial plant height (cm) of Burley neutral flavor tobacco

Treatments	Replication			Total	Mean
	I	II	III		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	11.6	11.4	12.7	35.7	11.9
Farmers' Practice (NTA Recommended Fertilizer Rate)	11.5	10.7	10.3	32.5	10.8
Total	23.1	22.1	23.0	68.2	11.4

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	0.30333	1.151667	0.21 ns	19.00	99.00
Treatment	1	1.70667	1.70667	2.40 ns	18.51	98.49
Error	2	1.42333	0.711667			
Total	5	3.43333				

CV (%) = 7.42

Appendix Table 7. Final plant height (cm) of Burley neutral flavor tobacco

Treatments	Replication			Total	Mean
	I	II	III		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	159.8	164.6	161.8	486.2	162.1
Farmers' Practice (NTA Recommended Fertilizer Rate)	157.3	158.0	158.1	473.4	157.8
Total	317.1	322.6	319.9	959.6	159.9

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	7.56333	3.781667	1.70 ns	19.00	99.00
Treatment	1	27.30667	27.3066667	12.29 ns	18.51	98.49
Error	2	4.44333	2.221667			
Total	5	39.31333				

CV (%) = 0.93

Appendix Table 8. Number of harvested leaves of Burley neutral flavor tobacco

Treatments	Replication			Total	Mean
	I	II	III		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	31.0	31.4	30.9	93.3	31.1
Farmers'Practice (NTA Recommended Fertilizer Rate)	29.5	29.7	29.6	88.8	29.6
Total	60.5	61.1	60.5	182.1	30.4

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	0.12000	0.06000	3.00 ns	19.00	99.00
Treatment	1	3.37500	3.37500	168.75 **	18.51	98.49
Error	2	0.04000	0.02000			
Total	5	3.53500				

CV (%) = 0.47

Appendix Table 9. Leaf length (cm) of 10th leaf of Burley neutral flavor tobacco

Treatments	Replication			Total	Mean
	I	II	III		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	47.6	47.8	48.2	143.6	47.9
Farmers'Practice (NTA Recommended Fertilizer Rate)	45.6	45.0	45.3	135.9	45.3
Total	93.2	92.8	93.5	279.5	46.6

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	0.12333	0.0616667	0.51 ns	19.00	99.00
Treatment	1	9.88167	9.8816667	81.22 *	18.51	98.49
Error	2	0.24333	0.1216667			
Total	5	10.24833				

CV (%) = 0.75

Appendix Table 10. Leaf width (cm) of 10th leaf of Burley neutral flavor tobacco

Treatments	Replication			Total	Mean
	I	II	III		
NTA Recommended Fertilizer Rate + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	26.9	27.1	27.0	81.0	27.0
Farmers' Practice (NTA Recommended Fertilizer Rate)	24.5	23.7	25.0	73.2	24.4
Total					

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	0.36000	0.18000	0.69 ns	19.00	99.00
Treatment	1	10.14000	10.14000	39.00 *	18.51	98.49
Error	2	0.52000	0.26000			
Total	5	11.02000				

CV (%) = 1.98

Appendix Table 11. Initial plant height (cm) of Cigar Filler tobacco

Treatments	Replication			Total	Mean
	I	II	III		
Farmers'Practice (NTA Recommended Fertilizer Rate)	30.0	23.2	21.0	74.2	24.7
NTA Recommended Fertilizer Rate (100%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	20.0	23.9	20.2	64.1	21.4
NTA Recommended Fertilizer Rate (75%)+ Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	23.7	23.4	24.1	71.2	23.7
NTA Recommended Fertilizer Rate (75%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor + 21-0-0	21.6	20.9	27.3	69.8	23.3
Total	95.3	91.4	92.6	279.3	23.3

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	1.99500	0.99750	0.08 ns	5.14	10.92
Treatment	3	17.93583	5.97861	0.47 ns	4.76	9.78
Error	6	76.57167	12.76194			
Total	11	96.50250				

CV (%) = 15.35

Appendix Table 12. Final plant height (cm) of Cigar Filler tobacco

Treatments	Replication			Total	Mean
	I	II	III		
Farmers'Practice (NTA Recommended Fertilizer Rate)	139	128	140	412	137.3
NTA Recommended Fertilizer Rate (100%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	136	137	146	419	139.7
NTA Recommended Fertilizer Rate (75%)+ Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	152	148	147	447	149.0
NTA Recommended Fertilizer Rate (75%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor + 21-0-0	147	144	154	445	148.5
Total	574	557	587	1718	143.2

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	246190.940	123095.5	3.79 ns	5.14	10.92
Treatment	3	322.757	107.6	5.21 ns	4.76	9.78
Error	6	123.913	20.700			
Total	11	246687.360				

CV (%) = 2.92

Appendix Table 13. Stalk length (cm) of Cigar Filler tobacco

Treatments	Replication			Total	Mean
	I	II	III		
Farmers'Practice (NTA Recommended Fertilizer Rate)	65.30	58.95	63.00	187.25	62.4
NTA Recommended Fertilizer Rate (100%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	61.65	56.40	53.45	171.5	57.2
NTA Recommended Fertilizer Rate (75%)+ Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	52.50	54.20	55.70	162.4	54.1
NTA Recommended Fertilizer Rate (75%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor + 21-0-0	53.4	51.2	60.9	165.5	55.2
Total	232.85	220.75	233.05	686.65	57.2

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	24.811167	12.405833	0.85 ns	5.14	10.92
Treatment	3	122.25562	40.751875	2.89 ns	4.76	9.78
Error	6	87.21500	14.535833			
Total	11	234.28229				

CV (%) = 6.66

Appendix Table 14. Number of harvestable leaves of Cigar Filler tobacco

Treatments	Replication			Total	Mean
	I	II	III		
Farmers' Practice (NTA Recommended Fertilizer Rate)	21.85	19.40	22.45	63.70	21.2
NTA Recommended Fertilizer Rate (100%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	22.00	21.15	21.65	64.80	21.6
NTA Recommended Fertilizer Rate (75%)+ Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	24.1	24.2	23.8	72.10	24.0
NTA Recommended Fertilizer Rate (75%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor + 21-0-0	23.30	23.80	25.40	72.50	24.2
Total	91.25	88.55	93.30	273.10	22.8

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	2.83792	1.4189583	1.62 ns	5.14	10.92
Treatment	3	21.82917	7.2763888	8.33 *	4.76	9.78
Error	6	5.24208	0.8736805			
Total	11	29.90917				

CV (%) = 4.11

Appendix Table 15. Leaf length (cm) of 10th leaf of Cigar Filler tobacco

Treatments	Replication			Total	Mean
	I	II	III		
Farmers' Practice (NTA Recommended Fertilizer Rate)	73.68	69.63	71.63	214.94	71.6
NTA Recommended Fertilizer Rate (100%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	70.33	76.13	76.05	222.51	74.2
NTA Recommended Fertilizer Rate (75%)+ Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	79.7	78.6	81.3	239.6	79.9
NTA Recommended Fertilizer Rate (75%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor + 21-0-0	78.8	76.75	79.2	234.75	78.3
Total	302.51	301.11	308.18	911.8	76.0

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	7.00782	3.5039083	0.69 ns	5.14	10.92
Treatment	3	126.93873	42.3129111	8.34 *	4.76	9.78
Error	6	30.45712	5.07618911			
Total	11	164.40367				

CV (%) = 2.97

Appendix Table 16. Leaf width (cm) of 10th leaf of Cigar Filler tobacco

Treatments	Replication			Total	Mean
	I	II	III		
Farmers' Practice (NTA Recommended Fertilizer Rate)	36.75	34.48	35.00	106.23	35.4
NTA Recommended Fertilizer Rate (100%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	34.38	38.25	38.05	110.68	36.9
NTA Recommended Fertilizer Rate (75%)+ Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor	39.50	38.95	40.95	119.4	39.8
NTA Recommended Fertilizer Rate (75%) + Hyfer Plus Foliar Fertilizer, endoROOTS & Solubor + 21-0-0	37.8	37.15	39.6	114.55	38.2
Total	148.43	148.83	153.6	450.86	37.6

Analysis of Variance

Sources of Variation	Df	Sum of Squares	Mean Squares	F-value	Tabular F	
					0.05	0.01
Replication	2	4.13682	2.068408	0.92 ns	5.14	10.92
Treatment	3	31.41763	10.4725444	4.64 ns	4.76	9.78
Error	6	13.54372	2.2572861			
Total	11	49.09817				

CV (%) = 4.00