EFFECTS OF MALEIC HYDRAZIDE ON THE GROWTH AND YIELD OF SWEET POTATO

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ABSTRACT

Sweet potato has the tendency to develop plenty of vines during the rainy season which can lead to low tuber production. Maleic hydrazide is a growth retardant which could inhibit vine development thus concentrating the photosynthates for tuber production. This study which was conducted at the La Granja National Crop Research and Development Center, La Carlota City from 1988 to 1990 investigated the effect of maleic hydrazide on the tuber yield of sweet potato, evaluated the degree of vegetative growth prior to and after the application of maleic hydrazide, and determined the spraying time and recommended rate of maleic hydrazide application.

Seventeen (17) treatments were used with 30, 45, 60 and 75 days after planting (DAP) as time of application and 0, 2.5, 3.5, 4.5 and 5.5 kg maleic hydrazide/ha as rates of application. Factorial in randomized complete block design was used.

In this three (3) years study, marketable, non-marketable and total tuber yields were significantly affected by spraying time and rate of maleic hydrazide application. Likewise, vine length after maleic hydrazide application was significantly affected. Results indicated that a maximum yield of sweet potato could be produced by spraying the plants 60 days after planting at 4.5 kg maleic hydrazide/ha (60 DAP-4.5 kg MH/ha). A marginal rate of return (MRR) of 307.72% was obtained from this treatment. All treatments applied with maleic hydrazide were significantly higher in yield than the control.

INTRODUCTION/RATIONALE

Sweet potato, scientifically known as *Ipomea batatas* Linn., is one of the major root crops in the Philippines. It is used as food for men and as feed for livestock. It is a source of raw materials in

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the manufacture of alcohol, carotene, juice, glue and syrup. Starch extracted from tubers is one of the materials used in textile and paper industries.

Statistics show that a total area of 164,300 hectares is planted to sweet potato in the Philippines with a total production of 777,178 metric tons (BAECON, 1985) or an average yield of 0.21 t/ha. Possibly one of the reasons for this low yield is inadequate production technologies especially on the cultural aspect of this crop. One technology which could contribute to increase production of sweet potato is the use of growth regulators.

Sweet potato could be planted during the wet and dry seasons. Generally, however, it is planted during the dry season where, solar radiation and temperature are high to favor efficient photosynthetic activities for rapid tuber formation. This ultimately produces better yield than the wet season planting. This phenomenon is brought about by abundant production of vines during the wet season due to excessive quantity of moisture in the soil and low solar radiation and temperature which are favorable for vegetative growth. Factors affecting the yield of sweet potato depend more on meteorological conditions. Cognizant of this, it is imperative to apply something such as use of plant regulators to check the detrimental effect of exuberant vine development, hence this study.

REVIEW OF LITERATURE

Excessive moisture in the soil and low solar radiation especially during the rainy season are favorable for vegetative growth but not good for tuber production. Plant regulators are organic compounds other than nutrients, which in small amounts promote, inhibit or otherwise modify any physiological process in plants (Devlin, 1975 and Salisbury, 1969).

Thompson in 1981 reported that maleic hydrazide is a growth retardant which when applied to any plant causes to inhibit its terminal growth. The use of maleic hydrazide on white potato has been newly introduced in the Philippines. In 1986 Baniqued found that the application of maleic hydrazide on white potato plants twenty (20) days before harvest can prolong the storage life and maintain the quality of tubers up to one hundred twenty (120) days.

OBJECTIVES

1. To investiate the effect of maleic hydrazide on the tuber yield of sweet potato.
2. To evaluate the degree of vegetative growth prior to and after application of maleic hydrazide.
3. To determine the recommended rate and spraying time of maleic hydrazide on sweet potato.

PROCEDURE/METHODOLOGY

Site. This study was conducted for three (3) years (1988 WS, 1989 WS and 1990 WS) at La Granja National Crop Research and Development Center, Bureau of Plant Industry, La Carlota City.

Treatments. Seventeen (17) treatments were used in this study with 30, 45, 60 and 75 days after planting (DAP) as time of application and 0, 2.5, 3.5, 4.5 and 5.5 kg maleic hydrazide/ha as rates of application.

Field layout. A total of fifty-one (51) 4-row plots measuring 4x6 m/plot with 1 m distance between rows were arranged in the experimental field using factorial in randomized complete block design replicated three (3) times. The distance between replication was two (2) m.

Planting the experiment. A recommended rate of 60-60-60 kg NPK/ha was applied before planting. Then terminal cuttings of sweet potato (VSp 4) 25 cm long were planted in ridges 30 cm between hills.

Application of maleic hydrazide. Maleic hydrazide at rates of 2.5, 3.5, 4.5 and 5.5 kg/ha diluted in 300 liters of water were applied to the plants 30, 45, 60 and 75 days after planting.

Cultural care and management. Handweeding, lifting of vines (2 times), cultivation and control of insect pests and diseases were done whenever necessary. The plants were harvested 120 days after planting.

Data collection. Yield and other pertinent data were taken from two (2) middle rows of each plot. Vine length was taken a day before maleic hydrazide application and two (2) days before harvest.

DISCUSSION OF RESULTS

Time and rate of maleic hydrazide application significantly increased the yield of sweet potato. All maleic hydrazide treatments with yields ranging from 12.59-20.61 t/ha were significantly higher than the control (12.57 t/ha), Table 1. The highest significant total tuber yield of 20.61 t/ha was obtained from plants sprayed at 60 days after planting at the rate of 4.5 kg maleic hydrazide/ha (60 DAP-4.5 kg MH) but it was also comparable to the yield of plants sprayed at 45 days after planting at the rate of 2.5 kg maleic hydrazide/ha (45 DAP-2.5 kg MH/ha) with 17.81 t/ha.

Table 1. Mean effect of time and rate of maleic hydrazide application on the yield of sweet potato, 1988 WS, 1989 WS and 1990 WS.

Treatment (Time-rate of application)	Tuber yield (t/ha)[1/] Marketable	Non-marketable	Total
1. 60 DAP - 4.5 Kg MH/ha	18.00a	2.61b	20.61a
2. 60 DAP - 4.5 Kg MH/ha	16.54ab	2.36b-d	18.90ab
3. 45 DAP - 2.5 Kg MH/ha	16.34abc	1.47b-k	17.81abc
4. 30 DAP - 2.5 Kg MH/ha	11.76a-h	5.35a	17.11bcd
5. 45 DAP - 3.5 Kg MH/ha	14.36b-f	2.22b-e	16.58bcd
6. 60 DAP - 3.5 Kg MH/ha	15.39a-d	1.10e-k	16.49bcd
7. 75 DAP - 4.5 Kg MH/ha	14.37b-e	1.56b-e	15.93bcde
8. 45 DAP - 4.5 Kg MH/ha	13.87b-g	1.81b-g	15.68cdef
9. 75 DAP - 4.5 Kg MH/ha	13.53b-h	1.98b-f	15.51cdefg
10. 30 DAP - 3.5 Kg MH/ha	12.79d-h	2.52bc	15.31cdefg
11. 75 DAP - 3.5 Kg MH/ha	13.44c-h	1.44b-k	14.88defg
12. 75 DAP - 2.5 Kg MH/ha	13.22d-h	0.87b-k	14.09defg
13. 30 DAP - 4.5 Kg MH/ha	12.83d-h	0.41k	13.24efg
14. 45 DAP - 5.5 Kg MH/ha	11.76e-h	1.17e-k	12.93efg
15. 30 DAP - 5.5 Kg MH/ha	12.08e-h	0.63h-k	12.71fg
16. 60 DAP - 2.5 Kg MH/ha	10.95gh	1.64b-i	12.59fg
17. Control - 0 Kg MH/ha	10.88h	1.69c-h	12.57g
C.V. (%)	10.47	31.10	9.61

Means followed by the same letter are not significantly different at 5% level DMRT.

[1/]Mean of 3 croppings

DAP - Days after planting.

Vine length was also significantly affected by time and rate of maleic hydrazide (application, Table 2. The longest vine difference after application of maleic hydrazide came from the control treatment with 92.13 cm, while the shortest, from plants at 75 days after planting sprayed at the rate of 5 kg maleic hydrazide/ha (75 DAP-5.5 kg Royal MH/ha) with 3.53 cm. Plants with the highest significant total tuber yield of 20.61 t/ha (60 DAP-4.5 kg MH/ha) got a vine length difference of 13.00 cm or a percentage growth suppression of 14.11%.

Table 2. Mean effect of time and rate of maleic hydrazide (Royal MH-30) application on the growth of sweet potato, 1988 WS, 1989 WS and 1990 WS.

Treatment (Time-rate of application)	Vine length (cm)[1/]			Degree of Vegetative growth after Royal MH-30 application (%)
	After Royal MH-30 application[2/]	Before Royal MH-30 application[2/]	Difference[4/]	
1. Control - 0 Kg MH/ha	177.50a	85.37	92.13a	-
2. 30 DAP - 2.5 Kg MH/ha	117.94b-k	73.06	44.88bc	48.71
3. 30 DAP - 3.5 Kg MH/ha	104.94jk	66.95	37.99bc	41.23
4. 30 DAP - 4.5 Kg MH/ha	107.12h-k	69.79	37.33bcd	40.52
5. 30 DAP - 5.5 Kg MH/ha	97.22k	68.28	28.94cde	31.41
6. 45 DAP - 2.5 Kg MH/ha	122.83e-k	100.11	22.72ef	24.66
7. 45 DAP - 3.5 Kg MH/ha	113.41g-k	92.64	20.77efg	22.54
8. 45 DAP - 4.5 Kg MH/ha	134.63b-i	115.39	19.24efgh	20.88
9. 60 DAP - 3.5 Kg MH/ha	143.97b-g	129.12	14.85fghi	16.12
10. 60 DAP - 2.5 Kg MH/ha	132.62b-i	118.70	13.92fghi	15.11
11. 45 DAP - 5.5 Kg MH/ha	117.14f-k	103.57	13.57fghi	14.73
12. 60 DAP - 4.5 Kg MH/ha	139.34b-g	126.34	13.00fghi	14.11
13. 60 DAP - 5.5 Kg MH/ha	131.68b-j	118.98	12.70fghi	13.78
14. 75 DAP - 2.5 Kg MH/ha	154.68abc	144.58	10.10fghi	10.96
15. 75 DAP - 3.5 Kg MH/ha	154.56a-d	146.27	8.29ghi	9.00
16. 75 DAP - 4.5 Kg MH/ha	147.39b-e	141.70	5.69i	6.17
17. 75 DAP - 5.5 Kg MH/ha	154.80ab	151.27	3.53i	3.83
C.V. (%)	10.02	10.64	27.66	

Means followed by the same letter are not significantly different at 5% level, DMRT.

1/ - Mean of a 3 croppings.
DAP - Days after planting

2/ - 2 days before harvest

3/ - 1 day before Royal MH-30 application

4/ Length of vine suppressed after application of Royal MH-30.

These results indicate that a maximum yield of sweet potato could be achieved with the right spraying time and rate of maleic hydrazide application which is 60 days after planting at 4.5 kg maleic hydrazide/ha (60 DAP-4.5 kg MH/ha). A vine length difference of 13.0 cm or a percentage growth suppression of 14.11% is optimum for maximum total tuber yield.

Economic analysis shows that 60 DAP-4.5 kg maleic hydrazide got a marginal rate of return (MRR) of 307.72%, Table 3. There were four (4) dominated treatments and the lowest MRR came from 75 DAP-45 kg maleic hydrazide with 51.69%.

Table 3. Economic analysis of sweet potato as affected by time and rate of maleic hydrazide (Royal MH-30) application.

Treatments	Marketable Tuber yield (t/ha)	Gross Benefit (P)	Treatment cost[2] (P)	Net Benefit (P)	MRR (%)
1. 0 kg Royal MH-30/ha (control)	10.88	32,640.00	7,202.00	25,348.00	–
2. 60 DAP - 2.5 kg MH/ha	10.95	32,850.00	7,547.00	25,303.00D	
3. 30 DAP - 2.5 kg MH/ha	11.76	35,280.00	8,074.00	27,206.00	213.17
4. 45 DAP - 5.5 kg MH/ha	11.76	35,280.00	8,434.00	26,846.00D	
5. 30 DAP - 5.5 kg MH/ha	12.08	36,240.00	8,642.00	27,598.00	69.01
6. 30 DAP - 3.5 kg MH/ha	12.79	38,370.00	8,863.00	29,507.00	863.80
7. 30 DAP - 4.5 kg MH/ha	12.83	38,490.00	9,009.00	29,481.00D	
8. 75 DAP - 2.5 kg MH/ha	13.22	39,660.00	9,023.00	30,637.00	706.25
9. 75 DAP 3.5 kg MH/ha	13.44	40,320.00	9,286.00	31,034.00	150.95
10. 75 DAP - 4.5 kg MH/ha	13.53	40,590.00	9,464.00	31,126.00	51.69
11. 45 DAP - 4.5 kg MH/ha	13.87	41,610.00	9,685.00	31,925.00	361.54
12. 45 DAP - 3.5 kg MH/ha	14.38	43,080.00	9,884.00	33,196.00	638.69
13. 75 DAP - 5.5 kg MH/ha	14.37	43,110.00	10,130.00	32,980.00D	
14. 60 DAP - 3.5 kg MH/ha	15.39	46,170.00	10,553.00	35,617.00	361.88
15. 45 DAP - 2.5 kg MH/ha	16.34	49,020.00	11,051.00	37,969.00	472.29
16. 60 DAP - 5.5 kg MH/ha	16.54	49,620.00	11,541.00	39,079.00	226.53
17. 60 DAP - 4.5 kg MH/ha	18.00	54,000.00	12,370.00	41,630.00	307.72

[1]Cost of tubers/kg = P3.00
[2]Include cost of Royal MH-30, application, harvesting and hauling of tubes.
MRR - Marginal rate of return.

CONCLUSIONS

The following conclusions could be drawn from results of this study:

1. In order to produce a maximum total tuber yield of 20.61 t/ha, the right spraying time for sweet potato is at 60 days after planting at the rate of 4.5 kg maleic hydrazide/ha (60 DAP - 4.5 MH/ha. This treatment is very profitable considering its marginal rate of return (MRR) of 307.72% for marketable tubers of 18.0 t/ ha.

2. A vine length difference of 13.0 cm or a percentage growth suppression of 14.11% is optimum for maximum production of sweet potato.

RECOMMENDATION

It is recommended that this generated technology on maleic hydrazide application on sweet potato be verified under farmers' field conditions before nationwide campaign for its use be disseminated to the farming populace.

BIBLIOGRAPHY

Baniqued, C.A. 1986. Effects of Royal MH-30 3G on the sprouting and storage of white potato. Plant Industry Bulletin, 1 (2): 1-12.

_____ and B.L.S. Marquez. 1986. Sweet potato. Plant Industry Production Guide (2).

Devlin, R.M. 1975. Natural Growth Hormones. Plant Physiology. Affiliated East-West Press PVT. LTD. 303-304.

Salisbury, E. and C. Ross. 1969. Plant Physiology. Wadsworth Publishing Co., California, 573-672.

Thompson, W.T. 1981. Agricultural Chemicals. Thompson Publishing Co., 74-76.