

EFFECT OF WEED CONTROL METHODS ON GROWTH AND YIELD OF WILLIAMS BANANA.

Ashour, N.E.*; A.S. Hosam El-Din** and A.A. M. Sallam***

*Hort. Dept. National Res. Center, El-Tahrir St., Doki, Egypt.

** Tropical Fruits Res. Dept., Hort. Res. Inst., Giza, Egypt.

*** Sufficiency Productivity Inst., Zagazig Univ., Egypt.

Abstract This study was carried out during two successive seasons of 2000 and 2001 on Williams banana plants grown in a private orchard at Nobaria to examine the effect of weed control methods on the vegetative growth, yield and fruit physical characteristics of banana plants. The weed control treatments included hand hoeing, plastic mulching, straw

mulching and Round up as a herbicide. Soil mulch and herbicide improved the vegetative growth for both pseudostem and sucker. Both mulching and herbicide treatments were effective in increasing the yield and fruit quality. Black polyethylene mulch gave the highest yield followed by transparent polyethylene, straw, and Round up.

Introduction

Banana is a rapid growing herbaceous plant. Therefore, the plant is a gross feeder and responds well to fertilization. Also, banana is considered as one of the exhaustive plants for water and nutrients. Weeds adversely affect plant growth and yield as they compete with the plants for nutrients and water. In addition to direct competitive effects of weeds on banana plants, weeds also harbour other pests such as insects, fungi, nematodes and bacteria. Weeds also excrete phytotoxic products and stimulate the occurrence of nematodes leading to

root damage (Kosmova, 1972). Therefore, weed control could be considered one of the most important cultural practices in banana plantation.

Any soil management system could be practiced and recommended, if it is inexpensive, gets rid of weed competition, provides an adequate level of soil moisture, maintains organic matter, favours the availability of nutrients, develops a soil with good aeration and doesn't injure the feeder surface roots (10 cm from soil surface of banana plant), thus improves plant growth, yield and fruit quality, as

well as reduces the costs of production.

Soil mulching was recorded as a safe method to control weeds in comparison to herbicides application (Abramova, 1984). Hifny *et al.* (1994) found that, using different mulching materials increased growth, yield and quality of Banaty grapevines. Rice straw mulching enhanced growth, flowering, yield and fruit quality of three banana cultivars namely Williams, Maghrabi and Poyo (El-Kholey, 1995).

Also, herbicide treatments are one of the traditional method for weeds control in fruit orchards. Herbicide combinations resulted in better weed control in peach orchard than did the monoherbicide treatment and yield was highly correlated with increased weed control (Welker, 1984). Reducing competition from weeds in plantings of peach trees by either cultivation or the use of herbicides resulted in increasing growth and productivity as herbicides are effective and safe in controlling vegetation in established peach plantings (Arnold and Aldrich, 1980). All treatments with herbicides controlled the grasses in banana cv. Giant Governor and resulted in the greatest growth, increase of yield and fruit quality (Sanyal *et al.*, 1989). Both herbicide treatments and hoeing treatments were effective in increasing the fruit weight and yield,

and induced almost the best physical and chemical characteristics of peach fruit (Abd El-Naby and Hassan, 1999).

The objective of this study was to investigate the response of growth parameter and yield components of Williams banana to soil mulching and using herbicide materials as tools for controlling weeds under newly reclaimed soil conditions.

Materials and Methods

This investigation was carried out during two successive seasons of 2000 and 2001 to study the effect of weed control methods on vegetative growth and yield of banana plants.

This study was performed on Williams banana (*Musa sp.*) growing in sandy loam soil with drip irrigation in a private orchard at Noharia. The plants were at 2.5 x 3.0 meters apart, received the normal cultural practices recommended for banana plantation in Egypt. Seventy-five plants free from diseases, uniform in growth were divided into five treatments. Each treatment was replicated three times (5 plants per each replicate) in a randomized complete block design. The applied treatments were the following

- 1- Black polyethylene mulch.
- 2- Transparent polyethylene mulch.
- 3- Dry banana leaves mulch.
- 4- Round up herbicide at 2 %

5- Hand hoeing (control)

Mulching with plastic covers and dry banana leaves (straw) was applied on 15th of March, while the herbicide was applied on March, May and July each year. Hand hoeing treatment was carried out on March as generally practiced in the farm at depth 10-15 cm.

Harvest date was estimated when the top hands and fingers became roundish and turned slightly yellow according to Van loescke (1950).

Measurements

I- Vegetative growth:

1 Pseudostem height: was measured from the soil surface up to the petiole of the last emerged leaf.

2 Pseudostem circumference: was measured at 20 cm above soil surface.

3. Sucker height: was measured as in (1).

4-Sucker circumference: was measured as in (2).

II. Yield:

The bunch of each plant was harvested and plant yield in response to different treatments was handled as follows: bunch weight (kg), number of hands per bunch and number of fingers per bunch were conducted.

III. Fruit physical characteristics:

1. Number of hands per bunch and number of fingers per hand.

2. Average finger weight: samples of 20 fingers were weighed and the average weight was calculated per (g).

3. Average finger length and diameter was determined using a vernier caliper (cm).

4 Angulation percentage: the equatorial diameter of two different sides were measured by using vernier caliper and angulation percent was estimated using the following equation:

$$\text{Angulation \%} = \frac{\text{Mean of total highest reading} - \text{Mean of total lowest reading}}{\text{Mean of total highest reading}}$$

The data were statistically analysed according to Gomez and Gomez (1984).

Results and Discussion

1. Effect of weed control treatments on vegetative growth:

Results presented in Table (1) show that, soil mulch using different mulching materials and herbicides on Williams banana generally improved pseudostem and sucker growth. The application of black or transparent polyethylene mulch led to significant

increase in both pseudostem and sucker length and circumference compared to control. Black polyethylene mulch was more effective in this respect compared with the other treatments during both seasons of study. Our results are in agreement with those obtained by Magherini and Sani (1984) who found that soil mulch with black polyethylene film has increased shoot length of young vines, var. "Perlette". El-Kholey (1995) found that plants grown on mulched plots produced statistically taller pseudostems than those on hand hoeing plots (not mulched).

It could be concluded that, soil mulch with different materials to control weeds has generally increased the vegetative growth of Williams banana. Also he found that soil mulch increased both (pseudostem height, circumference and sucker height and circumference).

Increase in vegetative growth could be attributed to several factors, including controlling of weeds that eliminated competition of soil nutrient, increased soil moisture retention and soil temperature as reported by Lippert *et al.*, 1964 and Kazantseva *et al.*, 1986. In addition, Takatori *et al.*, 1964 mentioned that transparent polyethylene mulching increased soil temperature during the day light hours to a depth of six

inches and retained some soil heat during the night. Other workers reported little increase in soil temperature with black polyethylene than clear one, which retained more soil heat during night. Similar conclusion was reported by Franklin and Roymond 1965, who found that straw mulch increased soil moisture in the upper 6-inch. Ramazaov (1985) suggested that the black polyethylene film has conserved soil moisture in upper soil layer and improved root and top growth of the vines and their development. Therefore, the stimulation of vegetative growth for both pseudostem and suckers in the present study with soil mulch could be due to the greater water uptake by roots than that of the control.

The mulches might affect not only soil temperature and moisture but also other conditions. According to Franklin and Raymond (1965), the rate of respiration of soil microorganisms and plant roots would be increased with an increase in soil moisture resulting from soil mulching.

2. Effect of weed control treatments on yield and its components:

- Number of hands per bunch:

The results in Table (2) clearly showed that all treatments used were effective in increasing the number of hands per bunch than the control

Plots mulched with transparent polyethylene gave the highest number of hands per bunch than other treatments. In this respect, the best results were obtained from transparent polyethylene mulch followed by black mulch, straw mulch and herbicide Round up according to the mean of the two seasons of this study

The results were in agreement with those obtained by El-Kholey (1995) who found that banana plants grown on mulched plots produced higher number of hands per bunch as compared with unmulched plants.

- Number of fingers per hand:

It is interesting to noticed from the same table that in both seasons the number of fingers per bunch responded to soil mulching. Black polyethylene mulch significantly increased number of fingers per hand as compared with the control. The other treatments caused a somewhat increase in number of finger per hand than control as the mean of two seasons of study. Our data are in harmony with those mentioned by Sarad and Chattopadhyay (1994) who found that the largest banana, from bunches with the highest number of hands per bunch and fingers per hand were obtained from mulch treatments.

Also, Sanyal *et al* (1989) reported that Paraquat at one liter /ha

resulted in the greatest height increase and fruit number per bunch of Giant Governor banana.

- Finger weight:

Data Table (2) indicated that mulching with different materials weeds control in the banana plantation has significantly increased the finger weight of Williams banana compared with the control. Also Round up significantly increase finger weight than control. Maximum increase was obtained with black polyethylene mulching followed by straw, transparent polyethylene and Round up. Our data agree with those reported by Chattopadhyay and Sarad (1996) who suggested that mulching with polyethylene resulted in the largest fingers followed by straw mulching.

- Yield/plant:

The yield of banana was greatly affected by different weed control treatments. Results in Table (2) clearly show that the all mulching and herbicide treatments significantly increased the yield per plant than the hand hoeing treatment. Black polyethylene mulching was the most effective treatment in this respect compared with the other treatments and control in both seasons of study. Assuming that number of bunches/feddan is about 1000, the average yield reaches 26.63 ton/fed for black polyethylene mulching

followed by 24.02 for transparent, for Round up and 16.08 ton/fed for 22.19 for dry banana leaves, 18.93 the control. In other words, weed

Table (1): Effect of soil mulch and herbicide treatments on the vegetative growth of Williams banana during 2000 and 2001

Treatment	Pseudostem height (cm)		Pseudostem circumference (cm)		Sucker height (cm)		Sucker circumference (cm)	
	2000	2001	2000	2001	2000	2001	2000	2001
Black polyethylene mulch	234.0	240.0	70.0	70.0	137.7	130.0	43.7	41.7
Transparent polyethylene mulch	218.7	219.3	67.7	66.0	126.0	123.3	41.3	40.7
Dry banana leaves mulch	209.0	205.0	66.3	66.7	126.0	121.7	41.7	38.3
Round up at 2 %	202.7	198.33	68.7	60.0	109.3	100.0	40.0	37.7
Hand hoeing (control)	190.0	190.0	62.3	55.0	97.7	96.7	33.3	31.7
L.S.D at 5 %	2.9	4.0	2.9	4.4	4.1	7.2	1.6	3.3

Table (2): Effect of soil mulch and herbicide treatments on yield and its components of Williams banana during 2000 and 2001.

Treatment	No. of hand / bunch			No. of Fingers / hand			Finger weight (gm)			Yield / plant (kg)	
	2000	2001	Mean	2000	2001	Mean	2000	2001	Mean	2000	2001
Black polyethylene mulch	10.66	11.33	10.99	20.33	21.00	20.7	113.67	120.33	117.00	24.63	28.63
Transparent polyethylene mulch	13.00	11.00	12.00	20.33	18.66	19.5	101.00	104.0	102.50	26.69	21.35
Dry banana leaves mulch	10.66	11.00	10.83	19.66	18.66	19.2	109.00	105.0	107.00	22.84	21.55
Round up at 2 %	10.00	10.66	10.33	18.66	19.33	19.0	97.66	95.33	96.49	18.22	19.64
Hand hoeing (control)	10.00	9.66	9.83	18.66	18.33	18.5	86.33	90.67	88.50	16.11	16.05
L.S.D at 5 %	2.56	1.02	-	0.98	1.49	-	4.33	3.73	-	1.23	1.04

control treatments can give between 17.7-65.6% increase in yield over control. The positive effect of mulching either with plastic or with straw on yield ascertained the importance of early controlling of weeds to eliminate the competition for soil moisture, nutrient and water relation. The enhancement of yield in this experiment is supported by the findings of Chattopadhyay and Sarad (1996) who found that mulching with polyethylene or straw resulted in the highest total yield of Giant Governor banana. Ray *et al* (1994) found that peach yield was substantially greater in pre-emergence herbicide plots compared with mowed-weed fescus turfgrass plots. Moreover, Hegazi (2000) working on grapevines, reported that there were significant differences, especially with black polyethylene mulch, followed by transparent one, herbicidal treatments, straw mulch, control and hoeing respectively. He also mentioned that the increase in yield due to the application of the treatments could be attributed to the effect on weed killing and eliminating competition with the vines for water and nutrients. Moreover, water saving percentage was 83.3% for black polyethylene covering, 66.6% for transparent one, 50% for banana straw and only 16% for hoeing. This means that water saving is great in case of using polyethylene covering compared to all other treatment and

grape growers can benefit much from using this technology not only for weed control but also for water saving. The same could be useful in banana plantation.

3. Effect of weed control treatments on physical characteristics:

- Finger length:

It is clear from Table (3) that both mulching treatments and herbicide had significant largest length values than the control as mean of two seasons under this study.

The best result in this respect was obtained with black polyethylene mulch, followed by straw and transparent polyethylene mulch, while Round up was the least effective.

- Finger diameter:

Data presented in Table (3) indicate that all weed control treatments significantly increased finger diameter of Williams banana than the control. Black polyethylene gave the highest significant effect in this respect.

- Angulation percent:

Data from Table (3) reveal that all mulching treatments and Round up treatment decreased the angulation percent compared with control. That is not astonishing, since these treatments, increased both

finger weight and dimensions than the control. In this respect, Abou Aziz *et al.* (1969) reported that the angulation percentage is one of the

principal parameters for using to determine banana fruit maturation. In other words, all treatments enhanced fruit maturation than the control

Table (3) Effect of soil mulch and herbicide treatments on fruit physical characteristics of Williams banana during 2000 and 2001

Treatment	Finger length (cm)			Finger diameter (cm)			Angulation %		
	2000	2001	Mean	2000	2001	Mean	2000	2001	Mean
Black polyethylene mulch	20.67	20.66	20.67	3.90	3.80	3.85	7.93	7.60	7.77
Transparent polyethylene mulch	19.33	19.33	19.33	3.56	3.50	3.53	8.36	8.06	8.21
Dry banana leaves mulch	20.33	20.0	20.17	3.30	3.36	3.33	8.50	8.46	8.48
Round up at 2 %	19.33	19.0	19.17	3.50	3.53	3.52	9.06	8.80	8.93
Hand hoeing (control)	17.67	18.33	18.0	3.06	3.20	3.13	9.17	8.87	9.02
L S D at 5 %	0.65	0.75	-	0.19	0.16	-	0.12	0.27	-

Cost analysis of weed control methods:

The cost of weed control treatments, varied greatly. Cost of plastic mulching is higher than all other treatments. If we consider its effects in killing all kinds of weeds and when used for more than one season, its cost is far less than herbicides. Most important plastic mulching can save about 50 % of the irrigation water in desert areas using water from deep wells. Since the cost of irrigation is one of the main

production factors in such areas. Straw or banana leaves mulching is also effective and its cost is very low specially in the mixed farms where such materials are available to reduce transportation cost. Herbicides could be used in highly infested locations in between the rows to avoid pollution or damage to the plants.

Conclusion:

In general, it could be recommended to apply mulching with plastic polyethylene in the early

stages of banana planting or straw to cover the space between the rows while herbicides could be used for killing the weeds growing in spots senteraling banana plants.

References

- Abd El-Naby, S.K.M. and A.A.A. Hassan (1999). Effect of some weed control methods on weed, yield and fruit quality of peach orchard Assiut J. Agric. Sci. Vol. 30 No. 1 59-74.
- Abou Aziz, A.B.; Y.A. Wally and S.M. El-Nabawy (1969) Artificial ripening of banana fruits. Fac. Agric., Ain Shams Univ., Res. Bul. 30.
- Abramova, L.S (1984) The use of black polyethylene in raising grapevine transplants. Vinoleoc I vinogradstvi SSR 1, 35 (C.F. Hort. Abst. 54: 4374).
- Arlond, C.E. and J.H. Aldrich (1980) Herbicidal effects on peach seedling growth and weed control HortScience 15(3). 293-294
- Chattopadhyay P.K. and G. Sarad (1996). Effect of soil cover on growth, flowering and yield of banana cv. Giant Governor. Progressive Horticulture. 25 (3/4) 181-183. (C.F. Hort. Abst., 66, 8122).
- El-Kholey, L.A.F. (1995) Response of some banana cultivars to different cultural treatments. Ph. D. Thesis, Fac. Agric Zagazig Univ.
- Franklin, D.S. and S.J. Raymond (1965). "Mulch effects on soil conditions and muskmelon response" Cornell University, Ithaca, New York.
- Gomez, K.A. and A.A. Gomez (1984) Statistical Procedures for Agricultural Research. Jhon Wiley and Sons, Inc. New York.
- Hegazi, A. H. (2000) Plastic mulching for weed control and water economy in vineyards Acta Hort 536: 245-251.
- Hifny, H.A.; G.A. Bagdady and M.S. Arafa (1994) Response of growth and yield of "Banaty" grapevine to soil mulch as a tool for weed control Egypt J. Hort 21 No. 1, pp 81-92
- Kazantseva, L.P., T.M. Ramazanoov and D.I. Furse (1986). Effect of microclimate on the productivity of grapevines on slopes mulched with black polyethylene film. Trudy Ujrajskogo Regional nogo II Goskomgidrometa 20, 59
- Kosinova, J. (1972). Studies on weed flora in Egypt. Year Book, Egyptian Botanical Society 2. 1-6 (Weed Abst., 23. 1889)
- Lippert, L.F.; F.H. Takatori and F.L. Whiting (1964). Soil moisture under bands of petroleum and

- polyethylene mulches. Proc. Am. Soc. Hort. Sci., 84, 541.
- Magherini, R. and P. Sam (1984). Preliminary studies on to alternative methods of soil management for grapevine at the training stage. Informatore Agrario., 40(31): 49.
- Ramazaov, T M. (1985). Productivity of vineyards on steep slopes with uniform soil mulching. Referativnyi Zhurnal, 55 (Rasreivodstvo), 10, 55, 732.
- Ray, A J., J A. Merwin and W C. Stiles (1994). Groundcover management systems and preplant fertilizers influence peach tree growth, yield, micronutrient availability and uptake. HortSci., 29 (5): 205
- Sanyal, D.; B. Sakar and S.K. Mtra (1989). Herbicidal weed control in banana. Pesticides 23(6): 29-33 (C F Hort Abst., 61, 1574).
- Sarad, G. and P K. Chattopadhyay (1994). Influence of soil cover on production and quality of banana. Annals of Agricultural research 15(4): 445-447 (C F Hort Abst , 65, 8429)
- Takatori, F H., L.F. Lippert and F I. Whiting (1964). The effect of petroleum mulch and polyethylene films on soil temperature and plant growth. Proc. Am. Soc. Hort. Sci , 84, 532.
- Van loescke, H W (1950). Banana Chemistry, Technology. Second Revised Edition. Interscience Publishers, Inc., New York and London, pp. 189.
- Welker, W V Jr (1984). The effect of oryzalin along and in combination with durn and simazine on young Peach trees. HortScience, 19: 824-826

تأثير استخدام طرق مختلفة لمقاومة الحشائش على نمو ومحصول العوز الوليامز.

نجاح النعماني عاشور*، أحمد سعد حسام الدين** و عبدالقادر عبدالقادر سلام***

* قسم بحوث البساتين - المركز القومي للبحوث - الحى - القاهرة

** قسم بحوث الفاكهة الإستوائية - مركز البحوث الزراعية - الجيزة

*** قسم الثروة النباتية - معهد الكفاية الإنتاجية - جامعة الزقازيق

اجريت هذه الدراسة عامى ٢٠٠٠ ، ٢٠٠١ على نباتات العوز صنف وليامز نامية فى مزرعه حاصه بمنطقة النوبارية تحت ظروف الأراضى الرملية والررى بالتنقيط بعرض دراسة تأثير الطرق المختلفة لمقاومة الحشائش على النمو الخضرى والمحصول لنباتات العوز الوليامز.

وقد شملت المعاملات:

- ١- التغطية بالبلاستيك الأسود.
- ٢- التغطية بالبلاستيك الشفاف.
- ٣- التغطية بأوراق العوز الجافة (مخلفات المزرعة).
- ٤- الرش بمبيد الحشائش (راوند أب) بمعدل ٢ %.
- ٥- التعريق البدوى (كنترول).

وكانت اهم النتائج ما بلى:

- ١- أدت المعاملة بالمواد الثلاثة المستعملة فى تغطية سطح التربة لمقاومة الحشائش فى مزارع العوز بالإضافة إلى الراوند أب إلى زيادة معنوية فى النمو الخضرى وقد أعطت المعاملة بالبلاستيك الأسود أعلى زيادة فى النمو الخضرى يليه البلاستيك الشفاف ثم القش والراوند أب.
- ٢- أدت هذه المعاملات إلى تحسين معنوى فى كل من قطر وطول الأصبع وكذلك عدد الكفوف وبالتالي زيادة المحصول بنسبة تتراوح بين ١٧,٧- ٦٥,٦% لنباتات المقارنة التى لم يستخدم فيها أى نوع من التغطية أو مبيدات الحشائش.

يمكن التوصية بتغطية المسافات حول النباتات بالبلاستيك أو القش ورش باقى المسافة ببيس الخطوط بمبيدات الحشائش لتقليل التلوث البيئى أو تقادى حدوث أضرار للنباتات وزيادة المحصول.