

Integrated Pest Management

IPM 1

INTEGRATED MANAGEMENT APPROACHES STRATEGIES FOR CONTROLLING CERTAIN COTTON KEY PESTS IN MIDDEL EGYPT. Ahmed A. Amin and Malak F. Gergis, Plant Protection Research Institute, ARC, 7 Nady El-Sayied Street, Dokki, Giza 12311, Egypt, Email: aahakaa@yahoo.com

In Egypt, insect pests attack reduced yield and quality of cotton, and oil content in the seeds. The cotton leaf worm (*Spodoptera littoralis*), the cotton pink bollworm, (*Pectinophora gossypiella*) and spiny bollworm (*Earias insulana*) cause the greatest damage in nearly one million feddans cultivated annually. This study describes an improvement in insect control practices directed against feeding insects (i.e., *S.littoralis*, *P. gossypiella* and *E. insulana*) by integration of insect monitoring, biological control, cultural, behavioral and genetic approaches that can serve as a base for the formulation of biologically- based new approach of integrated management of cotton key pests. Field studies were conducted during 2004 and 2005 cotton seasons at Minia Governorate, middle Egypt, with an experimental area of about 150 feddans of cotton (Giza 80). Five control measures were evaluated: (1) Prediction models based on the Pheromone trap catches; (2) Bio insecticides such Agreen (contains *Bacillus thuringiensis aegypti*) and Spinosad; (3) Insect Growth Regulators (Consult: Anti molting compound produced by Dow Agroscience; Cascade: Anti molting compound produced by American Cyanamid; Mimic Molting accelerating compound produced by Rhorm and Haas; (4) Plant growth regulators and Defoliant (Pex: Cotton leaf defoliant and Cytokin: Growth promoting and fruiting hormone compound produced by Rhorm and Haas); (5) Augmentation of *Trichogramma* sp. Various combinations of the tested components were formulated and applied in commercial cotton fields in two successive seasons. Percent of infestations, cotton yield and population density of both natural enemies and sucking pests were used as criteria for evaluation of the various measures. Results showed that: Agreen, Trichograma, Cascade, Consult, Mimic, Spinosad and convention insecticides gave reduction in infestation of the three tested pests by 34-75%, 22.1%, 37.7- 75.3%, 33.9- 71.4%, 38.8-74.5%, 67-77.1% and 63.4%, respectively.

IPM 2

INTEGRATED PEST MANAGEMENT PROGRAM FOR CONTROLLING CAPNODIS CARBONARIA KLUG AND C. TENEBRIONIS L. (COLEOPTERA: BUPRESTIDAE) IN IRBID GOVERNATE. Naim Sharaf and Lara Jaber, Plant Protection Department, Faculty of Agriculture, Jordan University, Jordan, Email: n.sharaf@ju.edu.jo

Three field experiments were conducted at Alaal (Irbid, Jordan) during the period of November 2003 to July 2004, to evaluate the different control measures against *Capnodis carbonaria* Klug and *C. tenebrionis* L. on stone-fruits and to establish an integrated pest management (IPM) program. Results based on yield analysis and percent kill calculation indicated that Confidor ranked first, followed by Mesurool and then Gusathion. The three pesticides increased yield by 67.38, 63.29 and 57.93%, respectively. Economic threshold (ET) for these beetle pests was calculated and revealed that control actions should be initiated at infestation level of one insect per tree. Efficacy of cultural and mechanical control measures was also examined. Results drawn by yield analysis and percent decrease in infestation calculation showed that fertilization ranked first and caused a significant increase in yield by 67.44% on the average. Pruning and adult hand-collection ranked second and third by causing 64.93% and 63.97% increase in yield on the average, respectively. In view of the above-mentioned results, the integration of the previously examined control measures in an IPM program against the devastating attack of *C. carbonaria* and *C. tenebrionis* to stone-fruits was carried out in a third field experiment. Findings will be discussed and possible management tactics will be presented.

IPM 3

FAO INPUTS IN THE PEACH FRUIT FLY (*BACTROCERA ZONATA*) MANAGEMENT IN THE NMIDDLE EAST AND NORTH AFRICA REGIONS. Khaled Alrouechdi, FAO-Sub regional Office for North Africa (SNEA), B.P. 300, Cité Mahrajène 1082 Le Belvédèr, Tunis, Tunisia, Email: Khaled.Alrouechdi@fao.org

The Peach Fruit Fly (PFF) (*Bactrocera zonata*) is considered as the most dangerous pest attacking many fruits, such as mango, guava, peach, apricot, plum, pear, papaya, citrus, figs, and date, in addition to secondary vegetable hosts such as cucurbits, tomato and others. When not treated, the PFF can affect all the

yield. In the Near East region, the pest is, at present, mainly located in Egypt, Yemen, Iran, Saudi Arabia, Oman, UAE and also in Ghaza District. Should this pest spread to PFF-free countries around the Mediterranean Basin and get established, the economic impact on the domestic and export market fruit production could be in the order of US\$ millions per year as a consequence of increased direct damage, insecticide use, quarantine restrictions, cost of certification programs (including post harvest treatments), and environmental impact costs. The FAO regional project on PFF management, aimed successfully to face this serious pest and to prevent its spread. This project helped also to identify the pest in many countries and to support the national programs concerning the control of the pest and prevent its disastrous spread to other areas. The FAO is looking for a new phase for this project with field training (on both national and regional levels), providing international expertise and necessary equipment necessary for the detection, monitoring & control of the pest as well as phytosanitary measures and information exchange. The present paper reviews the current status of PFF and its management in the Middle East & North Africa regions.

IPM 4

THE COMPLEMENTARITY BETWEEN THE USE OF TREGARD AND PREDATORS *COCCINELL SEPTEMPUNCTATA* IN *APHIS FABAE* CONTROL. Nizar Mustafa Al-Mallah and Jouhina Edris Mohamed Ali, Plant Protection Department, Faculty of Agriculture and Forest, Mousel University, Iraq, Email: e_madk@maktoob.com

The complementarity between different concentrations of tregard (0.5, 3, 1.5%) and the method of application (by treating the leaf only; leaf and aphid; leaf, aphid, adult male and female of lady birds) were evaluated in terms of their killing rate and predacious efficiency. Tregard killing rate of aphids increased with increased concentration and reached 84.2% at a concentration of 0.55%, 24 hours after treatment, and male predators were more sensitive to tregard females. Predacious efficiency reached 53.1 and 52.6% for females and males, respectively, following tregard leaf spray. However, killing rate reached 47.1 and 39.1% for males and females, respectively, five days after treatment of leaves, aphids and adult males and females of ladybirds.

IPM 5

THE TRADITIONAL METHODS OF INTEGRATED PEST MANAGEMENT ARE A PROMISING STRATEGY TO REDUCE POPULATION DENSITY OF COFFEE BERRY MOTH *PROPHANTIS SMARAGDINA* (BUTLER) IN THE FIELD. Hassan Soliman Mahdi¹, Amin Al Hakimi², Mohamed Mahyoub³, Ahmed Sayef³, Saeed Al Sharjabi⁴, Fredric Pola⁵. (1) Plant Protection Department, Faculty of Agriculture, Sana'a University, P. O. Box 14430 Sana'a, Republic of Yemen, Email hsamahdi@yahoo.com; (2) Yemeni Genetic Resources center, Faculty of Agriculture, Sana'a University; (3) General Department of Plant Protection, Ministry of Agriculture and Irrigation (MAI); (4) Classification and Industrialization, Coffee Department, MAI; (5) French Embassy/ Technical Cooperation (French Food Aid Counterpart Funds).

Coffee, one of the 5 national strategic crops for export in Yemen, suffers from many problems leading to low yields and quality. Among these, the coffee berry moth (*Prophantis smaragdina* (Butler)) (Pyralidae: Lepidoptera), is by far the most important pest of coffee in the country and can cause losses up to 50% of the total production in some seasons. Among the traditional methods used to control this pest were the application of branches of Athab tree (*Ficus salicifolius*) inside coffee tree, smoking by burning cow manure at night during full moon and removing newly infested parts of trees attacked by the insect and burning them. The study was conducted during two seasons in most commonly growing coffee regions in the country; Medinat Ash-Sharq, Dhamar governorate and Wadi Yahar, Lahj province. During 2004 season, the results indicated that Athab branches followed by smoking treatments reduced the population density of coffee berry moth in comparison to the control. Results also showed that the Athab branches treatment was the most effective in reducing the rate of fruits infestation (3.29% and 6% for Medinat Ash-Sharq, and Wadi Yahar, respectively) in comparison to the other treatments either smoking treatment (4.64% and 13% for the two region, respectively) or sanitation treatment (4.79% and 12.21% for the two region, respectively). During 2005 season, the results showed that all traditional methods decreased the population density of coffee berry moth in comparison to the control. However the population density of coffee berry moth in the combined treatment (Athab + smoking + sanitation) continued to be low until the end of the season in

comparison to the control. Results have also showed that the combined treatment (Athab + smoking + sanitation) was the most effective in reducing the rate of fruits infestation (4.71% and 5.79% for Medinat Ash-Sharq and Wadi Yahar, respectively) in comparison to the other treatments, smoking and sanitation (8.79% and 12.79% for the two region, respectively) or the use of Athab and sanitation (5.14% and 12.64% for the two region, respectively). The population density of coffee berry moth was higher during 2004 and 2005 seasons in Wadi Yahar than that at Medinat Ash-Sharq. During this study one local parasitoid, *Elasmus* sp. (Eulophidae: Hymenoptera) was recorded on coffee berry moth larva in Medinat Ash- Sharq during June, 2005 with parasitism rate of 11.11%.

IPM 6

NEW APPROACHES FOR BOLLWORMS CONTROL. Abd El-Aziz Abou El-Ela Khidr, Plant Protection Research Institute, ARC, Dokki, Giza 12618, Egypt, Email: prof.abdelaziz.aboueela@gmail.com

Cotton is the most important crop in Egypt as well as in other countries in the world. Pink bollworm; *Pectinophora gossypiella* (Saund.) and spiny bollworm; *Earias insulana* (Boisd.) are considered the main pests infesting cotton plants. These pests attack the fruit parts of the cotton plants such as buds, flowers and green bolls. This investigation is intended to control bollworms by using sex attractant pheromones with the following objectives in mind: protection of the ecosystem from insecticidal pollution, reducing the insecticides dosages, delaying the emergence of resistance in the pest to the insecticide and to keep the natural enemies which represent the most important factor in the integrated pest management to maintain their role in controlling many pests. The methods of pheromone application used included: 1) pheromone baited traps for the timing of the application (besides the green boll inspection). This procedure was effective in reducing the infestation rates caused by bollworms from 7% to be less than 2%; 2) Mass trapping was effective in reducing the infestation levels with bollworms due to the disturbance in the sex ratio. This method could be utilized at low infestation rates rather than at high infestation levels; 3) Attractant and kill technique was implemented to attract the male moths by the pheromone in order to be killed by the insecticide substance in the mixture of pheromone and insecticide. This method reduced significantly the rates of infestation as well as insecticides used in comparison to using insecticides alone for bollworms control.

IPM 7

EFFECT OF SOME ELEMENTS OF INTEGRATED PEST MANAGEMENT ON THE CONTROL OF PINK BOLLWORM. Abd El-Aziz Abou El-Ela Khidr¹, I.H. El-Namaky¹, A.I.Gadallah² and S.M. El-Awady². (1) Plant Protection Research Institute, ARC, Dokki, Giza, 12618 Egypt; (2) Faculty of Agriculture, Al-Azhar University, Cairo, Egypt, Email: prof.abdelaziz.aboueela@gmail.com

Pink bollworm, *Pectinophora gossypiella* (Sound.) is the most important pest infesting cotton plants and causing considerable loss of cotton yield in Egypt. The extensive use of insecticides for the pest control had created several problems, such as polluting the environment, development of resistance and disturbance of normal balance between the pests and their natural enemies. The objective of this study was to evaluate some elements of integrated pest management for pink bollworm control. Insects control by the mating disruption technique is achieved by the wide spread application of synthetic pheromone formulation over the crop. The insects are then unable to locate their mates when using their own pheromone and mating activity is therefore reduced. The aim of this work was to protect green bolls from the pest damage. Results revealed that when the application of pheromone is integrated with insecticidal treatments had a highly significant reduction on the green bolls infestation with pink bollworm as compared with using insecticides alone, where the reduction in infestation was around 37%. It was noticed that the predators number in the pheromone treated area was two fold of that in the insecticides treated area. The enzymes activity in the larvae collected from the insecticides treated area was much higher than that in the pheromone treated area because of selection for resistance in the pest due to the extensive use of insecticides. Infestation rates caused by the pest and the insecticides used were higher in the late planting as compared with early planting.

IPM 8

INTEGRATION OF INHERITED STERILITY AND MASS TRAPPING TECHNIQUES FOR THE CONTROL OF THE CAROB MOTH *ECTOMYELOIS CERATONIAE* IN A POMEGRANATE ORCHARD. Jouda Mediouni, Laboratoire de Protection des Végétaux, Institut National de la Recherche Agronomique de Tunisie, 49 Rue Hedi Karray, 2049 Ariana, Tunis, Tunisia, Email: joudamediouni@lycos.com

The Carob moth *Ectomyelois ceratoniae* Zeller (Lepidoptera: Pyralidae) is a polyphagous insect that causes serious damage on several host-plants both in storage and in the field in Tunisia and in the Mediterranean basin and Near East regions. Results showed the compatibility of these control methods and their potential to reduce the natural insect population. At harvest, the assessment of fruit damage in treated field showed a very low infestation compared to the control. Indeed, after 3 years of entire season releases and mass trapping, an incidence of 1.25% of fruit infestation was obtained against 25% in the control orchard.

IPM 9

INTEGRATION OF THE INSECT GROWTH REGULATOR NOMOLT AND TWO PREDATORS (*METASYRPHUS COROLLA* F. AND *COCCINELLA UNDECIMPUNCTATA* L.) FOR CONTROLLING *APHIS FABAE* SCOP. Sahil K. Al-Jameel and Guhiana I. Mohamud Ali, Plant Protection Department, College of Agriculture and Forestry, Mosul University, Iraq, Email nadeemramadan@yahoo.com

Studies were conducted to evaluate the predacious efficiency of two predators, *Metasyrphus corollae* F. (Syrphidae: Diptera) and *Coccinella undecimpunctata* L. (Coccinellidae: Coleoptera), and their integration with IGR Nomolt to control *Aphis fabae* Scop. (Aphididae: Homoptera). Results indicated that both larval predators had great feeding ability on nymphs and adults of *A. fabae*; they consumed an average of 137.53, 116.26 and 166.6, 195.15 nymphs and adults of *M. corolla* and *C. undecimpunctata* respectively. The results indicated that Nomolt (0.5 cm/l) gave highest mortality of *A. fabae* (88.3 %) at 40 nymphs/plant. The combined effect of IGR and two densities of predators also showed significant effect when prey density, IGR and predators density were used. Rate of prey death reached 100% when Nomolt and two predators (one and two larvae) and a prey density of 20 and 40 nymphs/plant were used. However, with the prey density 40 nymphs/plant and using IGR and one larva of *M. corolla*, the death rate reached 77.7%.

IPM 10

DEVELOPEMENT AND IMPROVEMENT OF IPM ON NAVEL AND MAROC LATE CITRUS VARIETIES IN SIDI SLIMANE AREA, NORTH-WEST OF MOROCCO. C. Smaili¹, M. Afellah¹, T. Bihi², J. Wadjinny³, M. Sebahji¹ and M. Zemzami². (1) Entomology Laboratory, INRA Kenitra, BP 239, Morocco, Email: csmaili@yahoo.fr; (2) Domaines Agricoles, UCP Sale Morocco; (3) Regional Plant Protection Inspection, BP 148, Kenitra Morocco.

The development and improvement of IPM on two citrus varieties Navel and Maroc Late, was carried out in Sidi Slimane area, at the north western part of Morocco during the period 2002-2005. A new vision of integrated pest management was practiced and improved on a large scale with pilot citrus producers. Many techniques were carried out and several thousands of parasitoids *Aphytis melinus* were released against the red California scale. The results showed that the species including *Aonidiella aurantii*, *Parlatoria pergandii*, *Lepidosaphes beckii*, *P. ziziphi*, *Ceratitis capitata* and snails were the major pests of this area. During this period, none of the treatments were applied against aphids, whiteflies, leafminer and mites. On the other hand, none or very little bait spraying method was executed for medfly on Maroc Late and Navel varieties. The impact of all used techniques in the context of IPM was discussed. During harvest, the fruit infestation rates were economically tolerable < 2% for medfly and < 1% or almost null for the scale insects). An adequate and methodic diagram of IPM was elaborated in order to control these principal citrus pests for this area. This new IPM strategy can be used also against Medfly in combination with the sterile insect technique.

IPM 11

INTEGRATED MANAGEMENT OF DATE PALM DISEASES IN THE ARAB GULF COUNTRIES. Emad Hussain Al-Turaihi, Ministry of Municipal Affairs and Agriculture, Agricultural Development Department, P.O. Box 1966, Doha, Qatar, Email: al_turaihi@yahoo.com

Date palm (*Phoenix dactylifera* L.) is considered to be one of the most important fruit trees in all of the Arab Gulf countries. It is also planted as an ornamental tree in public gardens and alongside the roads. All parts of the tree may be subject to attack by fungal diseases such as: terminal bud rot (*Thielaviopsis paradoxa*), black scorch (*T. paradoxa*), false smut (*Graphiola phoenicis*), leaf base rot (*Diplodia phoenicum*), leaf spots (*Alternaria* spp., *Cladosporium* spp., *Helminthosporium* spp. and others) and inflorescence rot (*Mauginiella scaettae*). This study showed that the movement of diseases had been facilitated by increased travel and trade exchange of agricultural products between and within Arab Gulf countries, in addition to suitable climatic and agricultural conditions. Integrated crop management (ICM) is a cropping strategy in which the farmer seeks to conserve and enhance the environment while economically producing safe, wholesome food. Its long term aim is to optimize the needs of consumers, society, the environment and the farmer. The study also revealed that the components of integrated crop management (ICM) such as quarantine legislation -the first line of defense-, biological control, resistant cultivars, tissue culture, plant extracts, crop husbandry and hygiene, bunch cover, avoiding of inter-cropping culture, and agricultural practices -irrigation, fertilization, harvest and storage- offered an environment friendly alternative to harmful chemical fungicides. However, integrated crop management options need to be developed where they could be used in integrated crop management/production programme.

IPM 12

INTEGRATED CONTROL OF *RHIZOCTONIA SOLANI* ON TOMATO. Mohamad S. Hassan¹, D.Q. Al-Obaidy² and A.K. bdulhadi². (1) Plant Protection Department, College of Agriculture, University of Baghdad, Iraq; (2) Al-Musayab Technology College, Iraq, Email: Mohamad2004S@yahoo.com.

A study conducted in Almusayab Tech. College to integrate chemical and biological control of *Rhizoctonia solani*. Results showed the Benlate and Beltanol fungicides were strong inhibitors to radial growth of *R. solani* and *Trichoderma harzianum* (100%) at rates of 0.5, 1.0 and 1.5 g/l under laboratory conditions. Growth of *R. solani* and *Trichoderma harzianum* was reduced by 62.8% and 36.9% by the application of Techazol, respectively. Soil treatment with Techazol and *T. harzianum* gave the lowest rate of pre-emergence damping off (10.0%), post emergence damping off (2.90%) and infection severity (5.69%). Whereas root and shoot weights were increased (0.71 and 3.70 g/plant, respectively). No significant differences were recorded between values of this treatment and values of treatment of tomato seeds by Techazol and soil treatment with *T. harzianum*, meanwhile these differences were significant compared to control treatments.

IPM 13

USE OF ORGANIC MANURES IN CONTROLLING *FUSARIUM SOLANI*. Mohamad S. Hassan¹, A.K. Abdulhadi² and D.Q. Al-Obaidy². (1) Plant Protection Department, College of Agriculture, University of Baghdad, Iraq; (2) Al-Musayab Tech. College, Iraq, Email: Mohamad2004S@yahoo.com

Triticum harzianum isolated from horses manure revealed 1.75 antagonism degree according to Bell's scale. Reduction rate of pre-and post-emergence damping off caused by *Fusarium solani* was achieved by applying a combination of isolated fungi from sewage waste and manure of cow, sheep, horses and poultry, and were 30.13, 25.13, 26.35, 23.43, 24.30% and 32.00, 25.58, 27.45, 25.83, 26.13%, respectively. The infection severity of these treatments were 43.16, 33.52, 81.20, 32.40 and 32.50%, respectively, as compared to a pre- and post-emergence damping off in control treatment of 54.8 and 56.9%, respectively.

IPM 14

INTEGRATED CONTROL OF SESAME ROOT ROT DISEASE IN NINEVAH PROVINCE. Ali Kareem Al-Taae¹, N.B.S. Al-Lashi¹ and M.B. Ismael². (1) Plant Protection Department, College of Agriculture and Forestry, Mosul, Iraq, Email aaltaae@yahoo.co.uk; (2) Biology Department, College of Science University of Mosul, Iraq.

The effect of the pelleting of sesame seeds with chemical and biocontrol elements on the incidence and disease severity of sesame root rot was evaluated. Dual treatments resulted in a significant decrease of root rot incidence and severity in comparison with the individual treatments. The treatment of sesame transplants with xanthan significantly decreased root-rot incidence and severity, compared to the treatment with Arabic gum. Treating transplants with Beltanol and *Trichoderma harzianum* reduced root rot incidence and severity to 16.66% and 0.10, respectively compared to xanthan treatment. The effect of pelleting the seeds with chemical and biocontrol elements on root rot incidence and severity and different bean growth features three and four months after planting in the field. Pelleting the seeds with Beltanol and *T. harzianum* by using xanthan gave the least incidence and root-rot severity following both periods.

IPM 15

USING DIFFERENT APPROACHES TO CONTROL CUCUMBER ROOT ROT DISEASE CAUSED BY *PHYTOPHORA DRECHSLERI* TUCKER. Yaser A. Bani and Saleh H. Samir, Plant protection Department, College of Agriculture, Baghdad, Iraq, Email: Salehsamir2004@yahoo.com

The aim of this study was to evaluate different approaches to control the cucumber root disease caused by *Phytophthora drechsleri* which was isolated from cucumber infected root. Results indicated that all treatments achieved significant reduction in disease severity of *P. drechsleri* compared with the control treatment. Seed treatment with *Pseudomonas fluorescens* (4×10^8 c.f.u./ml) and two additions of bacterial inoculum with irrigation achieved lowest disease severity of 6.9%, followed by copper nutrient and biocontrol agent *Trichoderma harzianum* with Ridomil treatments which were added to infested soil with pathogen. These two treatments reduced disease severity to 9.7 and 12.9%, respectively, and all three treatments significantly increased dry weight of shoots, roots and plant length. Soil application with copper was more efficient in reducing disease severity (9.7%) compared with spraying (13.9%). Ridomil, Beltanol, and Tachigazol were effective in controlling *P. drechsleri*. Beltanol was the most effective in reducing of disease severity to 23.6%.

IPM 16

EVALUATION OF AN INTEGRATED CONTROL SYSTEM AND GRAFTING IN CONTROLLING FUSARIUM WILT AND ROOT-KNOT NEMATODE OF CUCURBITS IN JORDAN. M. Al-Qasim¹, Z. Musallam², Z. Nasser¹ and D. Mustafa¹. (1) National Center for Agricultural Research and Technology Transfer, P.O. Box 639, Baq'a 19381, Jordan, Email: mohdqasim@ncartt.com; (2) Quaranteen Laboratories, Department of plant protection, Ministry of Agriculture, Jordan.

Two separate tests were carried out to evaluate the efficacy of an integrated control system in controlling root-knot nematode and *Fusarium* wilt on cucumber at Jarash (north Jordan) and watermelon in Quirrah (south Jordan). The integrated control system included bio-fumigation of soil with fresh cow manure at 7 and 10 kg/m² for 21 days, then amending soil with either bio-control fungi (*Trichoderma* and *Paecilomyces*), chemical fertilizers, or no additives as control. A third test was carried out in Quirrah to evaluate the effect of grafting watermelon cv. Rasul-Abd on the rootstock "Tetsu Kuboto" (resistant to *Fusarium*) in controlling *Fusarium* wilt on watermelon. Results showed that bio-fumigation plus bio-control fungi were the most effective and reduced ($P \leq 0.05$) number of *Fusarium* propagules in cucumber soil by 42 - 60.5%, compared to the control. These treatments also reduced ($P \leq 0.05$) numbers of *Meloidogyne*-second stage juveniles in soil and root-knot indices at the end of the season. However, bio-fumigation plus chemical fertilizers have also reduced ($P \leq 0.05$) the wilt incidence of watermelon by *Fusarium* and also the numbers of *Fusarium* propagules in watermelon soil by 44.3 - 47.6%, compared to the control. Grafting was very effective and reduced wilting of watermelon by 64.7%, leading to an increase in watermelon yield by 60%, compared to the control.

IPM 17

THE USE OF TRANSPLANTING AS A METHOD FOR CONTROL ROOT-ROT OF SESAME WITH OTHER CONTROL METHODS UNDER GREENHOUSE CONDITIONS. Najwa B. Alasee, Biology Department, College of Sciences, Mosul University, Iraq, Email: najwab_2005@yahoo.com

This experiment was performed to determine the efficiency of using transplanting as a method to control root-rot disease of sesame seeds (local cultivar) were planted in plastic boxes filled with sterilized mixture of soil and peatmoss (2:1). Healthy one month seedlings were chosen for planting in pots, and the soil was contaminated with a mixture of the fungi: *Macrophomina phaseolina*, *Fusarium solani*, *Pythium aphanidermatum* at the rate of dish/fungus/pot. Each replicate included 50 treatments. Roots of transplants were treated before planting with the different biocontrol agents or fungicides. *Trichoderma harzianum*, two *Trichoderma viride* isolates, and bacterial biocontrol agents, such as *Pseudomonas fluorescens* and *Bacillus subtilis* were applied as conidial or spore suspensions. Also Techiazol, Beltanol and celest were used as fungicidal suspensions at the rate of 3 ml/l. The transplants were also treated with a mixture of each fungicide with every species of the biocontrol agents. Infection rate and severity of the disease, average length of shoots and roots, average leaf area, number of pods and branches, and dry weight of the plant were measured, 3 months after treatment. Results obtained will be presented.

IPM 18

THE USE SOLARIZATION IN WEEDS AND NEMATODE MANAGEMENT. Ezarug A. Edongali and Tunis M. Mohamed, College of Agriculture, El-Fatih University, Tripoli, Libya, Email: Edongali48@hotmail.com

A study was conducted to evaluate the efficacy of transparent and black plastic covers in soil solarization for the management of root-knot population (*Meloidogyne javanica*) and weeds, and their subsequent effect on growth and productivity of tomato (*Lycopersicon esculentum*) and eggplants (*Solanum melongenum*). Results indicated that the efficiency of both treatments were almost identical on the reduction of nematode population in the first year of trial, while the black cover was more efficient in the second season. Reduction of nematode population reached 66.8-88.0% for transparent cover and 81.5-100% for black cover. Root gall indices were significantly lower in both treatment compared with the untreated control. Growth of both crops were not significantly different from each other, but were significantly higher than the untreated plants. All weeds were not able to grow except Bermuda grass (*Cynodm dactylon*), which was more tolerant to solarization. Results also showed that soil temperature was 20°C higher under cover compared with the uncovered control.

IPM 19

EFFECTS OF SOLAR HEATING IN POLYETHYLENE MULCHED OR UN-MULCHED SOIL OF FUSARIUM WILT AND RHIZOCTONIA ROOT ROT INCIDENCE OF CUCUMBER PLANTS UNDER GREENHOUSE CONDITIONS. Eman S. Farrag¹ and Y.O. Fotouh². (1) Plant Pathology Department, Faculty of Agriculture, Quina, South Valley University, Egypt; (2) Plant Pathology Department, National Research Centre, Giza, Egypt, Email: eman_farrag@yahoo.com

Effect of solar heating in mulched or un-mulched soil on Fusarium wilt or Rhizoctonia root rot diseases under greenhouse conditions were studied. Isolation and pathogenicity test indicated that the most severe fungus was *Fusarium oxysporium* f.sp. *cucumerinum* (isolate No. 2), which caused wilt disease incidence of 26.4 and 67.7% at the pre- and post-emergence stages of cucumber, respectively. Meanwhile, the root rot fungus, *R. solani* (isolate No.2) caused 41.0 and 71.0% at pre- and post-emergence growth stages of cucumber, respectively. Nylon net bags containing artificially infested soil with *oxysporium* f.sp. *cucumerinum* or *R. solani* inocula were buried 10 -20 cm below soil surface in either mulched or un-mulched soil for 4, 6, or 8 weeks to evaluate mulching effects on reduction of fungal population density and diseases incidence. Results indicated that the reduction of fungal population increased as the period of soil mulching was prolonged. The highest reduction in *F. oxysporium* f.sp. *cucumerinum* and *R. solani* population (99%) was obtained in soil mulched for 8 weeks and decreased gradually to reach its minimum (55%) after 4 weeks of soil mulching. Fungal population reduction in un-mulching soil followed the same trend. Cucumber plants were transplanted in pots containing previously buried soil under mulching or un-mulching conditions. Effect of soil solarization on cucumber wilt or root rot incidence was evaluated under

greenhouse conditions. The highest reduction in Fusarium wilt or Rhizoctonia root rot was obtained in soil mulched for 8 weeks. Although mulched soil reduced the wilt or root rot diseases after 6 and 8 weeks, there was no significant reduction after 4 weeks. The results obtained indicated that the fungus remained active for 4 weeks in un-mulched soil. It could be suggested that soil solarization for 8 weeks proved highly effective to reduce cucumber wilt and root rot incidence and could be considered as practical treatment for controlling these soil borne plant pathogens.

IPM 20

RECENT TRENDS IN THE MANAGEMENT OF WHEAT DISEASES IN GLOBAL LEVEL. Salah Eddin Khabbaz, D. Ladhakshmi and V. Valluvapardasan, Department of Plant Pathology, Centre for Plant Protection Studies, Tamil nadu Agricultural University (TNAU), Coimbatore-3, India, Email: salah_edk@yahoo.co.uk, salahthalal@rediffmail.com

Wheat is the world's most widely cultivated food crop. It contains more proteins than other cereals and relatively high content of niacin and thiamine. It is one of the most important staple food crops and suffers from several diseases. The major diseases of wheat are rust, head blight, powdery mildew, smut, and bunt. Many diseases of wheat cause significant reduction in yield and quality if not properly managed. Eighty four per cent yield loss of wheat due to rust attack is reported from Australia. Eighty five per cent of the worldwide fungicide is used on wheat (US \$ 1.589 billion). Hence IDM (Integrated Disease Management) should be adopted. In Canada, powdery mildew is managed by the application of silicon which induces cell defense mechanism against the disease. ICARDA (International Centre for Agricultural Research in the Dry Areas) is working on the screening of germplasm against rust diseases. Many developed and developing countries identified sources of resistance genes viz., *Lr 21*, *Lr 35*, *Lr 46* and *Sr 39* against the most important rust diseases. Management of take all disease by the application of biocontrol agents viz., *Pseudomonas fluorescens*, *P. aureofaciens* has been reported. Genetically engineered wheat plants with mammalian anti-viral gene showed resistance against wheat stripe mosaic virus. Tools are developed in Germany, to detect fungal spore and weather factors for precise diagnosis which help in advanced planning of disease management. As a whole, management of the disease should apply all the available methods that are ecofriendly and economic to get a sustainable yield.

IPM 21

INTEGRATED MANAGEMENT OF PRODUCTION AND PEST CONTROL OF GREENHOUSE CROPS. Khalifa, H. Dabaj¹, Mustafa H. Blak², Ayiad I. Al-Haji² and Emhammed M. Essoul². (1) Department of Plant Protection, Faculty of Agriculture, Al-Fateh University, Tripoli, Libya, E-mail: dabajhk@yahoo.com; (2) Agriculture Research Centre, Tripoli, Libya.

An integrated management program for production and pest control of greenhouse crops was applied during the last three growing seasons 2003/2004, 2004/2005 and 2005/2006 in the western region of Libya. The management program included: Soil solarization, installing insect-proof nets, planting on plastic soil mulches, pruning and training of plants, placement of sticky insect traps, sanitation, use of bumble bee as pollinators, and good quality transplants. Results indicated that application of this program led to effective control of soil-inhabiting and air-borne pathogens and pests. The main advantages of this program are reduced need for multiple applications of pesticides and less consumption of irrigation water. In addition, there was an increase in production and improvement in quality. Ultimately, it is hoped that this approach will lead to less build-up of resistance in pests and less contamination of the environment.