Jurnal Sumberdaya HAYATI Desember 2018
Vol. 4 No. 1, hlm 1-6 Available online at:
http://biologi.ipb.ac.id/jurnal/index.php/jsdhayati

Environment-Friendly Cultivation of Shallot on Sandy Land as Specified Location in Yogyakarta

Kultivasi Bawang Merah Ramah Lingkungan di Wilayah Berpasir Spesifik di Yogyakarta

SUTARDI* dan HENI PORWONINSIH

Researcher Assessment Institute for Agricultural Technology Yogyakarta, Yogyakarta, Indonesia

Diterima 28 Februari 2018 /Disetujui 23 Juli 2018

Shallot is one of strategic commodities in Indonesia. Sandy coastal area of Bantul and Kulon Progo districtis the centre of shallot production in Yogyakarta. The results showed that recommendation of fertilizing technology ameliorant (clay 2:1), organik fertilizer 20 ton/ha, Urea 115.7 kg/ha, ZA 250 kg/ha, SP-36 75 kg/ha, and KCl 250 kg/ha. Pest and disease management in integrated pest and disease management 10 Feromon – Exi, Attractant, 10 Light trap, 45 Yellow/white/green trap, biopesticide, limited chemical pesticide, organophosphate pesticide residue contents below with residues below the (<MRL).

Key words: Shallots, Antractant, organophosphate, environmental

INTRODUCTION

The potentials and prospects of shallot cultivation in sandy area in Dareah Istimewa Yogyakarta with the width of 3,300 ha is located along the southern coast of Kabupaten Bantul and Kulonprogo. The sandy area has advantages to be used as agricultural land: wide, flat, small frequency of flood, huge amount of sunlight, and its depth of groundwater is shallow (Anonim 2002). Furthermore, the area preparation is simple, only by making bedsheet and the existent of deep trench is not necessary, therefore it is possible to have an effective cost of soil cultivation. Coastal sandy area also also has problem which is the low productivity of the marginal area. Some of the limiting factors are the low buffering and saving ability of water, high infiltration and evaporation, very low fertility and organic materials, and the low efficiency of water usage (Kertonegoro 2001; Al-Omran *et al.* 2004).

Aside from abiotic factors, another obstacle is biotic problem especially pest attack during the summer in the cultivation of shallot. Plant Disturbing Organisms controlling (plant pests) for the time being still depends on the usage of pesticide, and it has not been combined with the environment friendly system. According to (Holmer *et al.* 2008; Atakan and Ramazan 2004; Liburd and Nyoike 2008), yellow traps could minimize and monitor the attacks or mobilization of whiteflies or insects in fields and to predict the danger of virus infection or any other infectious diseases. The most interesting and efficient trap for monitoring especially for whiteflies or any other insects is the yellow colored one and it is best if installed vertically because it has the highest amount of trapped whiteflies compared to the blue trap, green trap, red trap, white trap, and black ones (Idries *et al.* 2012). One of the plants that had been researched before the effective way to control pests is known, is the light trap with the use of solar cell.

In order to support the cultivation of shallot in accordance with the Good Agricultural Practices (GAP) and Standar Operasional Prosedur (SOP) in an environment friendly and edible way, an environment friendly plant disturbing organisms control is necessary. Some of the environment friendly plant disturbing organisms controls that had been introduced are light trap, yellow sticky trap, green sticky trap, white sticky trap, and Pheromon-Exi. The use of environment friendly plant disturbing organisms could minimize the use and the residue of pesticides to below the limit of tolerance. To complete the environment friendly plant disturbing organisms control, according to the study result in 2015, shows that the application of solar powered light trap could minimize the frequency of pesticide spraying from 15 times to only 5-6 times.

Control using the mentioned components has contributions toward the discontinuation of the life cycle. In order to get the success of shallot agriculture in both quantity and quality, the production security is necessary to protect from pests or diseases. The research aims to get the environment friendly way of control and the effects toward the result of shallot plantings. The hypothesis that are submitted in this research is some components of the controlling way to minimize plant disturbing organisms in order tto minimize the use of pesticide and to suppress the residue contents of organophosphates pesticide on shallots.

*Penulis korespondensi:
E-mail: s.pd_sutardi@yahoo.co.id

MATERIALS AND METHODS

Location and Time. The research is located in Kelompok Tani Manunggal, Srigading, Sanden, Bantul (07° 59’ 8,659” S, 110° 15’ 6,753” E), on June – September 2016. The effectiveness testing of solar powered light trap as super imposed trail on scalling-up area (3 ha) low residue shallot located in farmer grop“Tani Manunggal”, Srigading, Sanden, Bantul on May – September 2016.

Materials. The research materials consist of 3 kinds of seed of shallots varieties (saving age of 3 months), Urea fertilizer, SP-36, KCl, MPHP (silver-black plastic mulch), bamboo, woods, measuring instrument nam tags, digital weight scale, plastic bags, drawing instruments, stationary, etc. (pesticide materials, fungicide, and pests trap). The instruments used are cultivator and hand tractor, plant disturbing organisms control instruments (yellow sticky trap, white sticky trap, green sticky trap, Pheromon – Exi, and light trap), water pump, waterpot and others (computer and analysis instruments), open observation instruments (digital weight scale), sample bag, and soil laboratory instruments.

The shallot cultivation technology packed with specified location of sandy area is stated in Table1. The maintenance was done in accordance to the standard operational procedure of shallot cultivation with the specified location of sandy area (Dinas Pertanian D.I. Yogyakarta 2002) and the introduction of recommended silver-black plastic mulch.

The applied cultivation technology in this research is stated in Table 2. The light trap is turned on from 6 –10 pm. The researched are designed with randomized block design with 4 treatments that were repeated 5 times as stated below:

a. First treatment (57p) with the installment of 5 spots of light traps/ha and would be mobilized in every 7 days.
b. The second treatment (107p) by installing 10 spots of light traps/ha statistically without mobilization.
c. Third treatment (57p5k5p5b) by installing 5 spots of light traps/ha and mobilizing them in every 7 days combined with 5 spots of yellow traps, 5 spots of white traps, and 5 spots of blue traps.
d. Farmer patterned treatment (controlling).

Collection of Samples. Samples of shallot (*Allium cepa* var. Porbolinggo, Tiron Bantul and Crok Kuning) are taken after harvest time according to the treatment. Then a sample of 10 plants is composite according to their behavior, included in the labeled bag. The samples were code named and stored in glass bottles with tight covers to protect them from moisture and contamination. They were then stored in the refrigerator until ready for use.The tools used are Gas Chromatography (AGILENT 7890A) equipped with a detector FPD (Flame Photometric Detector), Balance analytical, Beaker glass, Pumpkin Measure, Measuring cup, Pipette Drops, flask, Pumpkin Evaporator, Column Chromatography, Knives, Plastic Containers, isooctane, dichlormetan, toluene, distilled water, a standard solution of organophosphate, shallot samples three variety mixed.

Table 1. Shallot cultivation technology system with specified location of sandy land

Technology components	Technology applications
Varieties	Probolinggo, Tiron Bantul and Crok Kuning
Seeds treatments	Reduction in warm water (45–50°C) for 15–30 minutes + PGPR (*Plant Growth Promoting Rhizobacter*)
The amount of seeds/size	Seed needed 0.75–1 t/ha, the size of seeds: 3-5 g/tuber)
Soil cultivation	Cultivation machine/hand tractor
Plastic mulch	Silver-black plastic mulch
Seedbed size	1 m wide in 20 cm and 50 cm deep of trench
Planting method	The seeds cut 1/3 part and then marinated before planted, inserted into the soil so it is parallel with the ground level
Planting distances	20 x 20 cm
Maintenance	Watering done in the morning (before sunrise) and in the afternoon
The recommendation of fertilization technology packet of the best result in 2015	Clay 3:1 are given once, and the next dosage were organic fertilizer 20 ton/ha, Urea 100, ZA 250, SP-36 150, and KCl 150 kg/ha, the application time for 100% fertilizer are pre-planting, by marinating it and mixing it with the organic fertilizer (exact 4).
Integrated Pest Management	PHT (Pheromon – Exi, light trap, yellow trap, white trap and green trap, biological agents, and limited chemical pesticide)
Harvesting and post-harvesting age	55-6- Dap, with tubers yield >95%, the root collar deflated, >90 plants collapsed, and the color of the tubers is bright

Data Analysis. The parameter measurement of plant disturbing organisms were done every week starting by counting the amount of trapped plant disturbing organisms on the light trap and other traps. The parameter measurement was direct observation of plant disturbing organisms found one. The input of pesticide is used when there were attack above the economy limit aside from farmer pattern treatment.

To identify the pesticide residue, organophosphate pesticide residue was collected on the shallot's tubers compositely.

1. The observed variables on the number of insect classes caught in the yellow, green, white, red, and trap light traps.
2. The harvest results were analyzed against Organophosphate group pesticide residues.

Statistical analysis that is used in descriptive analysis this experiment consists of variances analysis on 5% tangible levels. If the variances testing shows the tangible different effect, then it will be continued with Duncan Distance Testing (UJGD) on level 5%.

Tabel 2. Result of class catches insects (insects) on a model of environmentally pest and trap

Pest Ordo	Observation on age (insects/ha^{-1})			
	Week 4	Week 8	Week 12	Cumulative ha^{-1}
1. The first treatment (57p) with the installation of light trap as many as 5 points ha^{-1} to be moved every 7 days				
Diptera	8,533^b	9,481^b	33,186^b	51,201
Thysanotera	75,854^a	88,180^a	43,626^a	207,651
Hymenoptera	0	0	3,792^a	3,792
Hemiptera	11,378^b	0	0	11,378
Coleoptera	0	0	0	0
Lepidoptera	0	0	0	0
Acharina	5,689^b	16,119^a	32,238^a	54,046
2. The second treatment (107p) with the installation of light trap as many as 10 points ha^{-1} still not be moved				
Diptera	3,513^c	4,411^c	13,123^c	21,047
Thysanotera	15,744^b	18,280^b	23,713^b	57,737
Hymenoptera	0	0	3,691^b	3,691
Hemiptera	8,478^c	0	0	8,478
Coleoptera	0	0	0	0
Lepidoptera	0	0	0	0
Acharina	1,289^c	2,595^b	2,311^b	7,195
1. The third treatment (57p 5k 5p 5b) with the installation of light trap as many as 5 points ha^{-1} to be moved every 7 days in combination with thesticky yellow traps 5 points, white traps 5 points and blue trap 5 points				
Diptera	18,513^a	19,498^a	53,193 a	91,204
Thysanotera	75,854^a	88,188^a	43,616a	207,650
Hymenoptera	0	0	4,294 a	4,294
Hemiptera	12,978^a	0	0	12,978
Coleoptera	0	0	0	0
Lepidoptera	0	0	0	0
Acharina	17,002^a	17,024^a	3,325 b	37,351
2. Farmer treatment pattern				
Pesticides and fungicides	1. 15 times Control of pesticides 2. 4 times Control of Fungicide 3. Control of sped plant disturbing organisms			
Coevisien varian %	10.33	7.92	6.01	

Explanations: The catch onsticky yellow trap, green trap, white trap, Pheromones-Exi and light trap solar cell

Superskrip * = nyata pada $p < 0.05$, ** = nyata pada $p < 0.01$, tn = tidak berbeda nyata

RESULT AND DISCUSSION

For the time being, the light trap has been the mainstay in the international communication in Asia with the release of software Asian Migratory Insectsand Viruses Surveillance System (AMIVS) Asian Food and Agriculture Cooperation Intiative (AFACT) – Korea with other countries in Asia including Indonesia. Every country is obliged to update the ligh trap data and the existence of hollow dwarf and grass dwarf virus everyday or no later than once in a week, therefore the pest and diseases virus situation in Asia (Indonesia, Thailand, Vietnam, Cambodia, Laos, Korea, Philipines, Nepal, and Bangladesh) can be identified by the neighbor country to anticipate any migration (Baehaki 2012). The light trap is installed on the height of 150 – 250 cm from the ground level. The contribution of light trap is very high, e.g. the amount of brown leafhoppers trapped on 100 watt lamp reach the number of 491,922 /night on August 18, 2010, the amount of trapped yellow rice stem borer reached the number of 10,690 /night on March 18, 2011, and the trapped stone stavelin reached the number of 504,000 /night on June 3, 2012. On Table 2 is served the trapped result data of insects on light trap, yellow sticky trap, green sticky trap, and white sticky trap. On another side, the controlling of shallot caterpillar moth can be done with Pheromon – Exi, very specified, and can only trap one kind of pest, but the light trap is able to trap more than one kinds of insects (Table 2).

The observation result shows that most insects on shallot is Thysanotera (Thrips) treatment 1, 2, and 3. Insecticide pest in class Diptera (flies), followed by Acharina (mites) dominated the trap result for as long as the shallot grows. The class Hymuptera (bees) and Cole Plant Disturbing organisms (beetles) is not seen, it shows that the natural enemy doesn't grow in the area of shallot cultivation with sandy area (Table 2). According to (Holmer *et al.* 2008; Atakan and Ramazan 2004; Liburd and Nyoike 2008), yellow lacer trap can press and monitor attack or displacement of whitefly in the field and predict the danger of viral infections. The trap shows the most interesting and efficient to use in monitoring the silverleaf whitefly is yellow and mounted vertically as it has the highest number of whitefly caught compared with blue, green, red, white, and black (Idris *etal.* 2012).

The observation result shows that most insects on shallot is Thysanotera (Thrips) treatment 1, 2, and 3. Insecticide pest in class Diptera (flies), followed by Acharina (mites) dominated the trap result for as long as the shallot grows. The class Hymuptera (bees) and Cole Plant Disturbing organismsera (beetles) is not seen, it shows that the natural enemy doesn't grow in the area of shallot cultivation with sandy area pattern 1, 2, and 3 is related with pesticide usage control, according to the data from the farmers average control is 3 – 5 times, otherwise on pattern 4 (farmer) the controlling is done 10 – 15 times. The control on pattern 4 gets a high result because at the age of 45 dap the attack of shallot caterpillar has a very high intensity therefore the control is done in every 3 days (3+1). Sihombing *et al.* (2013) reported the results of research on tobacco plant that the highest pest population caught by yellow trap was 53.00 and the lowest pest population was 33.33 which were caught by light red trap.The lowest attack intensity percentage was 28.53% found in the yellow colored trap, and thehighest was 34.86% found in the blue colored trap.

The applications of pest controlling standard procedure should apply the newest economy limit according to the moth population monitoring using the light trap (Baehaki 2013). To proof that the environmental friendly control has successfully suppressing the residue of perticide, residue testing is done in Organophosphate (Tabel 3). The specific pesticide that is registered and permitted by The Ministry of Agriculture to control shallot plant disturbing organisms is noted with the amount of 151 formulation consisting of 74 kinds of active materials. In accordance to the data from (Balai Proteksi Tanaman Pangan Holtikultura Yogyakarta), it is noted that in 2008 – 2015, pesticide with the brand of Dursban 200EC and Curacron 500EC consisting of active chlorpyrifos and profenofos is still used by the farmers. This pesticide is generally used for rice plant and shallot. The lack of knowledge of the farmers about the danger of insufficient dosage and concentration of the recommended pesticide is also one of the factors that has been the cause of pesticide residue on vegetables.

The controlling of environment friendly shallot plant disturbing organisms with light trap, yellow sticky trap, green sticky trap, and white sticky trap in the earlier time has not been applied by the farmer in sandy area in Srigading, Sanden, Bantul. For two years, the introduction of environment friendly plant disturbing organisms control has been done and the farmers admitted that they felt much more helped because their harvested plants are twice better. The result of insects trap shows that it is effective enough therefore the usage of pesticide can be suppressed as low as possible. This proved that the result of the analysis on organophosphate pesticide residue in average resulted bellow the recommended BMR (Table 3). When used, pesticides contaminate the environment and accumulate in the food chain thereby posing hazards to human health (Blasco *et al.* 2003;Leong *et al.* 2007 ; Pesticide Action Network 2001).

Pesticides belong to differentchemical classes but the major ones are organochlorines, organophos-phates, carbamates and pyrethroids.Organochlorin being chemically stable and persistent in the environment have been banned in most countries of the world but the less persistent classes are widely in use. Organophosphates are highly potent compounds used mainly as insecticides especially in the control of storage insects in foodcrops. They are verytoxic and more often involved in acute poisoning than other classes of pesticides (Collins 2006;Mansour 2004; Ogah and Coker 2012). Based on the examination from 4 samples shallot by using Gas chromatography is seen in the Table 3.

Sungkawa (2008) reported that insecticide in the class organophosphate is one of insecticides that is the most general used by shallot farmer in Brebes regency with the application frequency ranges in 5 – 30 times per planting season (±60 days). The usage of chronic toxic insecticide like organophosphate is predicted to be the cause of the population equilibrium that resulted on the decreasing of biodiversities in some ecosystem. Some researches about pesticide residue on vegetables stated that insecticide residue in class organophosphate with the contents of profenofos and chlorypirifos on shallot 0.565–1.167 ppm in accordance to the maximum limit of residue for pesticide for pesticide chlorypirifos and profenofos which is 0.1 mg/kg (Afriyanto 2008).

The usage if profenofos is by spraying it from the air for six times in every season. Cuacron 500EC is commercial brand for pesticide with active mineral profenofos. This pesticide is included as stomach contact poison and has wide spectrum which is able to ract fast in controlling pests attack. The liquid of Curacron 500EC is not colored and is very easy to absorb into the plants tissue through the stomata

Table 3. Class Organophosphate pesticide residue content (mg/kg) at various of environmentally control on sandy land D.I.Yogyakarta

Analysis	Pattern 1 (57p)	Pattern 2 (107p)	Pattern 3 (57p 5k 5p 5b)	Pattern 4 Farmer	Maximum residue limit (MRL) SNI.7313. 2008	Explan actions
Diazinon	0.039	0.076	0.098	0.168	0.05	> MRL
Fenitrotion	0.030	0.042	0.032	0.054	0.05	< MRL
Metidation	< LD	< LD	< LD	0.150	0.1	< MRL
Malation	0.102	0.130	0.105	1.157	1	< MRL
Klorpirifos	0.120	0.120	0.138	0.118	0.1	> MRL
Paration	0.013	0.017	0.017	0.051	0.05	< MRL
Profenofos	< LD	< LD	< LD	< LD	0.1	< MRL

Source: Analysis of residue IAARD Balitan Jakenan, Pati, Jawa Tengah
Explanations: Maximum residue limit (MRL); Limit detection (LD)

therefore Curacron is effective to control the hidden pests behind the leaves. This pesticide is used to control shallot caterpillar pests (Indrayani 2006). The functions of light trap in BPTP Yogyakarta are: 1. The trapped pests are the result of early monitoring towards the varieties and the amount of immigrant pests that come to the planting is to identify the economy limit. If the light trap has trapped a borer moth, it s a must to immediately control it 4 days after the borer moth is trapped. This is to reduce the population of immigrant pests or migrant pests.

World case studies by WHO report that A total of 76 pesticide active ingredients, including pyrethroids, organophosphate and carbamates, were found to be in use, and 9% of these belong to the World Health Organization (WHO) toxicity class Ib (highly hazardous) (Jallow *et al.* 2016). Not only is this high input of pesticides perceived as necessary, but pesticide mixtures are also generally considered desirable. Farmers tend to apply pesticides too close to harvest because of lack of adequate knowledge regarding the safe and judicious use of pesticides (Jallow *et al.* 2017), potentially contaminating the crop prior to sending their produce to the market. Example in Kuwait pesticide residues have been detected in a number of vegetables and other food products (Sawaya *et al.*1999; Sawaya *et al.* 2000; Saeed *et al.* 2000; Saeed *et al.* 2001; Saeed *et al.* 2005). Although some residue levels were below the maximum limits allowed, a few were above the limits established for these pesticides in food (Mustapha *et al.* 2017).

Based on research results pesticide residue may be degradedand some may be directly evaporated. This finding are supported by Kumari *et al.* (2005), they reported that frying or cooking in oil was more effective in reduction of pesticide residues. Theirstudies indicated 39-55% reduction of Organochlorine residues and almost half of organophosphateresiduesfromvegetables. Similarly, washing with detergent followed by tap water washing of onion was also proved as aneffective method for reduction of pesticide residues since a considerable amount of pesticide residues were reduced during this process (Ahmed *et al.* 2018).

CONCLUSION

The controlling of diseased pests by using the technology of (1) seeds marinating (40–50°C), (2) PGPR, (3) yellow and green sticky trap, 15 spots per ha, (3) Pheromone – Exi to trap shallot caterpillar moths, 10 spots per ha, (4) solar powered light trap, 20 spots per ha to trap insects (trips, aphids, mites, etc.) is proved to have lower pesticide residue.

The light trap's solar cell result on treatments 1, 2, and 3 according to the amount of pesticide application is very efficient compared to farmer pattern (4). The amount of controlling frequency of pesticide on treatments 1, 2, and 3 decreases, reaching 70%, with the cost decreasing from 10–15 times to once per 3–5 days with plant disturbing organisms controlling. The catch of solar powered light trap plant disturbing organisms vector is the most, followed by yellow sticky trap, green sticky trap and white sticky trap,and pheromon-Exi, therefore the analysis of pesticide residue in the organophosphate is below < BMR.

ACKNOWLEDGMENTS

I thanked SMARTD Satker Agency for Agricultural Research and Development for research funding and kind cooperation of Head of AIAT Yogyakarta, Team Evaluator of BBP2TP Bogor, farmer groups "Manunggal" Tegal Rejo, Sri Gading sub distric, Sanden distric, Bantul regency.

DAFTAR PUSTAKA

Afriyanto. 2008. Kajian keracunan pestisida pada petani penyemprot cabe di Desa Candi Kecamatan Bandungan Kabupaten Semarang. Tesis: Program Pasca Sarjana. Universitas Diponegoro, Semarang.*J Tropic Agric Sci* 35:127-134. http://eprints.undip.ac.id/16405/1/AFRIYANTO.pdf [data akses 02 Nopember 2016].

Ahmed SS *et al.* 2015. Impact Of Traditional Processing On Pesticide Residues In Onion. *JMEAST* 1:1-19. http://jmeast.webs.com/JMEAST%20Issue%201,%20Vol%201-%20Paper%20002.pdf

Al-Omran AM *et al.* 2004. Clay Deposits for Water Management of Sandy Soils. *Arid Land Research and Management* 1:171-183.

Anonim. 2002. Aplikasi Unit Percontohan Agribisnis Terpadu di Lahan Pasir Pantai Daerah Istimewa Yogyakarta. Dinas Pertanian Tanaman Pangan Propinsi DIY dengan Fakultas Pertanian UGM Yogyakarta. 118h.

Baehaki SE. 2012. Data statistik tangkapan hama pada lampu perangkap (light trap) tahun 2011. Balai Besar Penelitian Tanaman Padi. 12p.

Baehaki SE. 2013. Teknologi Pengendalian Hama Penggerek Batang Padi. *Iptek Tanaman Pangan* 8:1-14.

Blasco C *et al.* 2003. Assessment of pesticide residues in honey samples from Portugal and Spain. *Journal of Agriculture and Food Chemistry* 51:8132-8138.

Collins D A. 2006. A review of alternatives to organophosphorus compounds for the control storage mites. *Journal of Stored Products Research* 42:395-426.

Dinas Pertanian D.I. Yogyakarta. 2002. Standar Operasional Prosedur (SOP) Bawang Merah Spesifik Lokasi. Dinas Pertanian D.I. Yogyakarta, 36 hal.

Holmer K, Simmons A M. 2008. Yellow sticky traps catches of parasitoid of *Bemisia tabaci* (Hemiptera : Aleyrodidae) in vegetable crops and their relationship to in field populations. *J Environ Ento* 37:391-399.

Idris A B *et al.* 2012. Effectiveness of sticky trap designs and colours in trapping alate whitefly, *Bemisia tabaci* (Gennadius) (Homiptera :Aleyroidae). *J Tropic Agric Sci* 35:127-134.

Indriyani A. 2006. Mengkaji Pengaruh Penyimpanan rajungan (PortunusPelagicus linn) Mentah dan Matang di Mini Plant Terhadap Mutu Daging di Plant. www.eprints.undip.ac.id/. [Data akses 31 Oktober 2010]

Jallow MFA *et al.* 2017. Pesticide Knowledge and safety practices among farm workers in Kuwait: Results of a survey. *Int J Environ Res Public Health* 14:340. doi:10.3390/ijerph14040340

Kertonegoro B D. 2001. Gumuk Pasir Pantai di D.I. Yogyakarta : Potensi dan Pemanfaatannya untuk Pertanian Berkelanjutan. Prosiding Seminar Nasional. Pemanfaatan Sumberdaya Lokal Untuk Pembangunan Pertanian Berkelanjutan. Universitas Wangsa Manggala pada tanggal 02 Oktober 2001. Hal 46-54.

Kumari B J *et al.* 2005. Monitoring of butter and ghee (clarified butter fat) for pesticidal contamination from cotton belt of Haryana, India. *J envi Sci* 105:111-120.

Leong K H *et al.* 2007. Contamination levels of selected organochlorine and organophosphate pesticides in the Selangor River, Malaysia between 2002 and 2003. *Chemosphere* 66:1153-1159.

Liburd OE, Nyoike TW. 2008. Biology and management of aphids in sustainable field production of cucurbits, viewed 20 January 2017.

Mansour SA. 2004. Pesticide exposure – Egyptian scene. *Toxicology* 198:91-115.

Mustapha FA *et al.* 2017. Monitoring of Pesticide Residues in Commonly Used Fruits and Vegetables in Kuwait. *Int J Environ Res Public Health* 14:833. doi:10.3390/ijerph14080833

Ogah CO, Coker HB. 2012. Quantification of Organophosphate and Carbamate Pesticide Residues in Maize. *Journal of Applied Pharmaceutical Science* 2:93-97. DOI: 10.7324/JAPS.2012.2919

Pesticide Action Network. 2001.The Hazards of Pesticide Use for Man and the Ecosystem. In: Pesticide Action Network (Ed.) *Pesticides in Tropical Agriculture – Hazards and Alternatives* (pp. 23 – 61).

Saeed T *et al.* 2005. Organophosphorus pesticide residue in the total diet of Kuwait. *Arab J Sci Eng* 30:17–27.

Saeed T *et al.* 2001. Chlorinated pesticides residues in the total diet of Kuwait. *Food Control* 12:91–98. doi: 10.1016/S0956-7135(00)00025-6

Saeed T *et al.* 2000. Assessment of the levels of chlorinated pesticides in breast milk in Kuwait. *J Food Addit Contam* 12:1013–1018. doi: 10.1080/02652030010002081

Sawaya W *et al.* 1999. Kuwait total diet study: Dietary intake of organochhlorine, carbamate, benzimidazole and phenylurea pesticide residues. *J AOAC Int* 82:1458–1465.

Sawaya W *et al.* 1999. Dietary intake of pesticides: Sate of Kuwait total diet study. *Food Addit Contam* 16:473–480. doi: 10.1080/026520399283768

Sawaya W *et al.* 2000. Dietary intake of organophosphate pesticides in Kuwait. *Food Chem* 89:331–338. doi: 10.1016/S0308-8146(99)00258-7

Sihombing SW *et al.* 2013. Pengaruh Perangkap Warna Berperekat Terhadap Hama Capside (*Cyrtopeltis tenuis* Reut) (Hemiptera:Miridae) Pada Tanaman Tembakau (*Nicotiana tabacum L.*). 1352. *Jurnal Online Agroekoteknologi* Vol.1, No.4, September 2013 ISSN No. 2337- 6597.

Standar Nasional Indonesia [SNI]. 2008. Batas Maksimum Pestisida. Batas maksimum residu pestisida padahasil pertanian SNI 7313:2008. ICS 65.100.01.1-147 PP

Sungkawa B. 2008. Hubungan riwayat paparan pestisida dengan kejadian goiter pada petani hortikultura di Kecamatan Ngablak Kabupaten Magelang. Tesis: Program Pasca Sarjana. Universitas Diponegoro, Semarang. http://eprints.undip.ac.id/17559/1/Hendra_Budi_Sungkawa.pdf. [Data Akses 03 Nopember 2016]