SURVEY OF WEED FLORAL COMPOSITION UNDER PINEAPPLE PLANTATION ON PEAT AND MINERAL SOIL

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ABSTRACT

Pineapple (Ananas comosus L. Merr.) is the third ranked tropical fruit contributed to the global market after Banana and Citrus. Weed is one of the biggest limitations reducing fruit's productivity and quality due to competition for natural resources such as nutrient, light, water and space. Therefore, this study was aimed to identify the type of weed species and to determine the most dominant weed species growth under different types of soil. Survey on weed population growth in pineapple is very important in weed management. It is because the quick changing of weed flora in response to changing agronomic management such as adoption of different planting methods. Widespread of weeds are also influenced by soil type, weather and environmental condition. Due to heavy weed infestation and resultant of yield reduction, pineapple cultivation has led to an over reliance on herbicides for controlling weeds, which is less sustainable for a long term weed control. Since very limited studies pertaining weed population growth in pineapple, proper documentation of this topic will contribute to better understanding for weed management, particularly in Malaysia. Weed composition survey was conducted in two different soil types of pineapple farms, namely Parit Yusof, Johor (peat soil) and Felcra Serkam, Melaka (mineral soil) according to the quantitative survey method by using standardized quadrat. Observations were done several weeks after herbicides application. The most dominant weed species recorded in peat soil was Axonopus compresus, followed by Paspalum conjugatum and Ageratum conyzoides. Whilst most abundant weed species recorded in mineral soil was Asystasia gangetica, Panicum spp and Mimosa pudica. Weed population was mostly dominated by broadleaves and grasses with very little contribution of sedges and fern. These findings will be the key tool for sustainable weed management since weed invasion is one of the most fundamental problem in pineapple plantation.

Key words: mineral soil, peat soil, pineapple, weed composition, weed survey

INTRODUCTION

Pineapple (*Ananas comosus* L. Merr.) is a tropical and economic fruit with encouraging potential in the global market and ranked third place due to its contribution approximately 20% production (Jaji et al., 2018). It is the first crop grown as a commodity crop in Malaysia and raised the country's position to a very significant level in the world between the late 60s and early 70s. Pineapple has vibrant flavour which mature fruit contains excellent source of sugar, protein, minerals and considerable calcium, potassium, fiber, as well as vitamin C which good for health. It was also widely used in food production such as jam flavor, jelly, canning products and others (Debnath et al., 2012). Unfortunately, Malaysian pineapple's contribution to the global market in the recent time has been experiencing downward trend, resulting to a set-back in its competitiveness. Weed infestation grow faster than pineapple cultivation is one of the factors reducing pineapple yield in a range 25 – 35% due to competition to get basic need of plant such as nutrient, light, water and CO_2 in order to survive (Fakayode et al., 2012). Weed is defined as a plant growth out of place or an unwanted plant or a plant with a negative impact to the man and environment (Sarkar et al., 2017). According to Reinhardt (2002), pineapple shows slow growth and superficial root system, factors that expose it to intense competition with weeds, and contribute to delay crop development and reduce their yield and quality. It is recommended to keep the fields clean from weeds during the first five to six months after planting. This study aimed to identify and characterize weed flora composition grown under pineapple cultivated in different soil types, mineral and peat soil. These findings will be the key tool for sustainable weed management since weed invasion is the one of the major problems in pineapple. The outcome of this study could be used as fundamental knowledge and support the decision making for controlling purposes particularly in herbicides selection in future by other researchers or farmers.

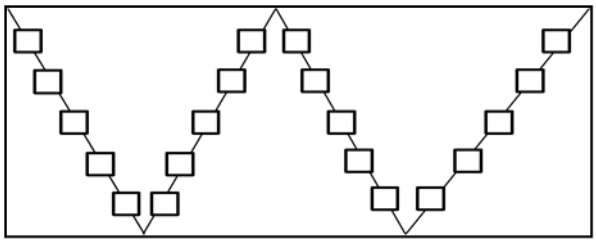
MATERIALS AND METHODS

A survey was conducted in two different soil types of pineapple farm in Parit Yusof, Muar Johor (peat soil) (2°06'01.7"N, 102°32'11.2"E) and FELCRA Serkam, Melaka (mineral soil) (2°11'49"N, 102°14'53"E). Monthly weather data consists of maximum and minimum temperatures ranging 27°c - 35°c and the light intensity range from 250 to 375 µmol/m. In total 10 farms fields including 5 from Muar and 5 from Serkam were surveyed. The fields were randomly selected within each surveyed area. The pineapple variety cultivated in selected farms was Josephine. The survey was conducted when pineapple was approximately

at 2 months after sowing. Farmers had already weeded or applied herbicides to the pineapple farms when surveys were conducted, which would generate information on weed species which might have survived or escaped the control measures.

The quantitative weed survey was performed according to the method carried out by Thomas (1985) and further applied by Hakim et al. (2011). An inverted 'W' pattern was adopted by walking systematically through each of sample fields as illustrated in Figure 1. Each transect of the inverted pattern comprised of five similar quadrats, giving total number of 20 quadrats per field. A quadrat of 0.5 m x 0.5 m was utilized in the survey and the main distinguished corner was considered as beginning point in each pineapple farm. The distance between each quadrats throw was fixed upon the size and shape of the farms. All weed species including grasses, sedges and broadleaved were identified, verified (Zimdahl et al., 1989; IRRI, 1983), counted and recorded in the logbook. Species that could not be recognized in the pineapple farm were labeled and transported for later identification.

Figure 1: An inverted 'W' survey pattern with each five equally quadrat which sum of 20 quadrats in 4 transects. The position of each quadrat in each transect were adjusted properly to cover the whole area of weed survey.



The data were summarized using quantitative measures comprised of Frequency and Relative Abundance according to the method of Thomas (1985) as follows:

A) Frequency (F) was calculated as the percentage of the total number of fields surveyed in which a species occurred in at least one quadrat.

B) B) Relative abundance (RA) value was obtained from the calculation based on relative frequency (RF), relative field uniformity (RFU) and relative mean field density (RMFD) values. RA values were crucial to determine and rank the status of various weed species predominating in certain areas, as they allow for comparisons of the total abundance of one weed species versus another (Thomas and Wise, 1987).

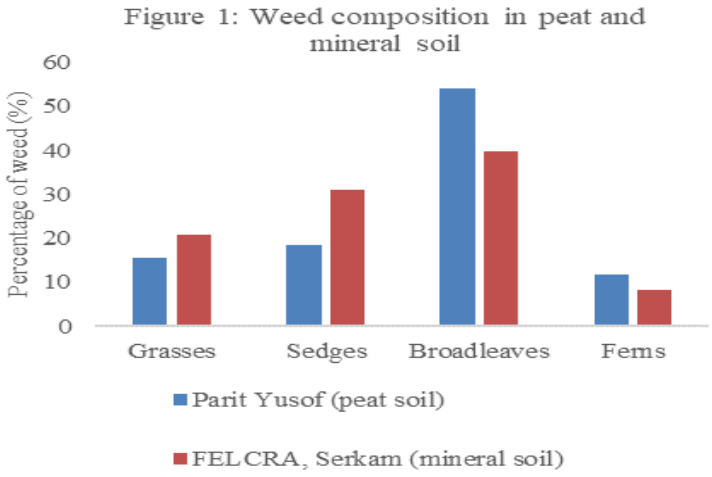
RESULTS AND DISCUSSIONS

Weed composition on peat and mineral soil

Figure 2 shows that broadleaves dominated pineapple farm more than 40% regardless of soil types. It was then followed by sedges, grasses and ferns. *Asystasia gangetica, Ageratum conyzoides, Cleome rutidosperma* and *Borreria latifolia* were among the broadleves species invaded both types of soil. Those broadleaves survive in pineapple due to its attributes such as fast establishment, rapid growth, early flowering anD some also serve as an alternative host for insect and pathogen compared to grasses and sedges (Shamimi et al., 2017).

Furthermore, higher weed percentage was oberved in peat soil compared to mineral soil in a range 5% to 20% for every weed types. According to Borowy et al., (2018), weed infestation is usually heavier in peat soil because it was being high in organic matter more than 65% compared to mineral soil at 35%, than lead to higher plant water holding capacity.

Figure 2: Distribution of weed composition in peat and mineral soil.



Frequency and Relative abundance in peat soil

A total of 18 weed species were identified in peat soil consisted of 4 species from grasses, 1 species from sedges, 11 species from broadleaf weeds and 2 species from fern (Table 1). All grasses were distributed (F) evenly in the field but *Axonopus compressus* was most dominant grass species invaded the same area due to high RA value. For sedge composition, *Cyperus compressus* potrayed higher RA value compared to *Fimbrystilis miliaceae*. *Ageratum conyzoides* was ranked highest compared to other broadleaves species at 21%. *Pteridum esculentum* was 5% lower compared to *Pityrogramma calomelanos* eventhough distibuted the most at 100%.

Table 1: Frequency (F) and Relative Abundant (RA) of weed species in peat soil.

Weed type	F (%)	RA (%)
Grasses		
Axonopus compressus	67	34
Paspalum conjugatum	67	27
Polygala paniculata	67	22
Sedge		
Fimbristylis miliaceae	100	18
Cyperus compressus	67	24
Broadleaves		
Cleome rutidosperma	67	21
Hedyotis corymbosa	100	12
Ageratum conyzoides	67	25
Asystasia gangetica	100	20
Physalis agulata	67	7
Borreria latifolia	100	11
Amaranthus spinosus	67	7
Erechtites valerianifolia	33	3
Melastoma malabathricum	67	10
Mikania micrantha	67	13
Volunteer palm oil seedling	100	12
Fern		
Pteridum esculentum	100	15
Pityrogramma calomelanos	67	20

Frequency and Relative abundance in mineral soil

16 weed species were recorded in mineral soil which was mostly dominated by broadleaves (10) followed by grasses (3), ferns (2) and sedge (1) (Table 2). *Panicum repens* was found dominant in mineral soil compoared with other grasses due to high RA value. Meanwhile, among the broadleaves, *Asystasia gangetica* was the most widespread species followed by *Mimosa pudica*. Both fern species distributed evenly at 67% but *Taenites blechnoides* appeard as most dominant fern in mineral soil.

Table 2: Frequency (F) and Relative Abundant (RA) of weed species in mineral soil

Weed type	F (%)	RA (%)
Grasses		
Eleusine indica	100	20
Digitaria ciliaris	100	16
Panicum repens	67	30
Sedge		
Cyperus rotundus	100	19
Broadleaves		
Asystasia gangetica	67	39
Mimosa pudica	100	22

Euphorbia hirta	100	13
Ageratum haustonium	67	19
Passiflora foetida	100	13
Merremia tridentata	67	16
Tridex procumbens	67	20
Amaranthus viridis	33	7
Centrosema pubescens	33	9
Volunteer palm oil seedling	67	15
Fern		
Dicranopteris linearis	67	19
Taenites blechnoides	67	24

The topmost distributed and dominance weed species regardless of soil types was broadleaves weed which *Asystasia gangetica* represented highest RA. *Asystasia gangetica* is an invasive weed in pineapple and other plantations due to its ability to produce large quantities of seeds, estimated produce around 27 million seeds per hectare, thrown as far as 6m and easily germinate so quickly dominate land (Yenni, et al., 2018). These results were parallel with Sarkar (2018), who observed the high dominance of *Melastoma malabathricum* and *Asystasia gangetica* in pineapple field at West Bengal, India. According to, Karim et al. (2004), several factors might affect the gradual changes in weed composition growth under different soil types such as soil characteristics, organic content, water holding capacity, cultural practices such as land preparation, use of agrochemicals and others. Thus, different weed composition was observed in this study. Soil texture plays an important role in crop cultivation as it influences soil available water capacity (AWC) (Fugen Dou et al., 2016). Higher content of organic matter would lead to higher AWC. These characteristics possessed by peat soil would cause higher weed infestation compared to mineral soil.

CONCLUSION

Management of weeds in any crop field is very crucial as weed has an ability to reduce crop yield to a significant level. Proper weed management in pineapple plantation has reduced suffering strong weed competion with pineapple fruits. Different weed interacts in different ways with the crop. Their activities are also dependent on the soil property and method of agricultural practices. Hence, without proper information regarding the identification and classification of weeds status it is impossible to control them.

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