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Determination of Harvesting Time of Three Peanut Varieties Based on Heat Unit Accumulation

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The aim of this study was to evaluate the development of pod stage in various harvesting time and to determine total daily heat unit of three peanut varieties in the best harvesting time. The experiment was conducted at IPB research station Leuwikopo-Dramaga, Bogor from February until June 2013. Each varieties were harvested at 85, 90, 95, 100, 105, 110 DAP. The results showed that Kelinci reached 50% of the population to flower at 376.85 °Cd with base temperature 13 °C, while Gajah and Jerapah reached at 391.80 °Cd. The best harvest time was determined by the highest percentage of full pod stage 2 and pod dry weight/plant. Peanut cv Gajah was harvested best at 90-100 DAP, cv Jerapah at 90 DAP and cv Kelinci at 105 DAP. Total daily heat unit accumulated at 90, 100, 105 and 110 DAP were 1346.35, 1489.50, 1562.25 °Cd, respectively.

***Keywords** : flowering time, full pod stage 1, full pod stage 2*

I. INTRODUCTION

The accurate assessment of harvesting time is one of the most important decisions to ensure the highest economic return to the grower. Underground pod as in peanut (*Arachis hypogaea* L.) make it relatively difficult to determine the best harvesting time. At harvest peanut pods are in various stage of development pod R2 until R9 [6]. Early harvested can cause loss yield due to low weight pod and pod quality. However, harvesting overly mature crop can cause loss yield due to deterioration of peg and pod, even some mature pod can be germinated.

There are several methods to determine pod maturity, such as days after planting, internal hull color, Heat Unit System, Effective Langleys Index, kernel density, seed/hull ratio (SHMI), arginine maturity index (AMI), physiological maturity index [5]. Heat unit system or degree days method found by Mills in year 1964 used a formula based on daily maximum and minimum temperatures to compute effective daily heat units. Total daily-heat unit counted up from planting until pod maturity. This method is easy to conduct on farm but have to be used cautiously because environmental factors other than temperature are not considered. [2] showed that degree day method that modified by the addition of seasonal cumulative water received by the crop can be used to determine peanut maturity.

Air and soil temperature influences all aspects of the growth and development of crops [4]. Crop responses differently toward temperature changing in every development stage, so other cultivars may require different number of effective heat units to reach maximum pod maturity.

The aim of this study was to evaluate the development of pod stage in various harvesting time and to determine total daily heat unit of three peanut varieties in the best harvesting time.

II. METHODOLOGY

Three peanut varieties Gajah, Jerapah and Kelinci were planted on February until June 2013 in Leuwikopo IPB Research Station, with the altitude of ± 210 m above sea level, average daily rainfall and temperature 327.8 mm and 23.4 °C, respectively. Soil type was acid latosol with pH of 5.10, medium CEC and low organic-C (1.83%).

Crop received 200 kg/ha combined fertilizer NPK 15:15:15 and 500 kg/ha $CaMg(CO3)_2$. Crop was harvested in 85, 90, 95, 100. 105, 110 and 115 DAP. Data collected included day of 50% population flowering, weight of dry pod/plant, percentage per plant of pod stage 1,2 and 3, half full pod, immature pod, deteriorated and germinated pod and daily heat unit using equation (1).

$$SP_n = \sum_{i=1}^{n} \left(\frac{t_{maks\,(i)} + t_{min\,(i)}}{2} \right) - t_b \quad \text{...Equation (1)}$$

SP_n = total daily heat unit (°Cd)

$t_{maks(i)}$ = maximum daily temperature (°C)

$t_{min(i)}$ = minimum daily temperature (°C)

t_b = ambient temperature (°C); 13 °C [1]

i = day after planting

At every harvest, pods were sorted based on pod development stage as showed in Tabel 1.

Table 1 Number of pod stage (%) in different harvest time

Pod Stage	Harvest Time (DAP)						
	85	90	95	100	105	110	115
				(%)			
Full-3	0.00 d	0.00 d	1.82 c	3.41 c	36.45 b	40.47 ab	45.90 a
Full-2	0.86 c	48.78 a	35.52 b	41.36 ab	14.94 c	5.69 d	4.33 d
Full-1	42.34 a	9.42 b	9.90 b	7.73 b	3.84 c	4.22 c	0.96 d
Half full	8.79 a	3.10 b	6.30 a	2.97 b	1.84 bc	2.64 bc	1.28 c
Immature	44.88 a	34.29 b	39.46 ab	39.40 ab	37.70 ab	36.68 ab	38.18 ab
Germinate	0.57 b	0.57 b	0.56 b	0.36 b	0.95 b	5.09 a	2.73 a
Deteriorate	2.56 b	3.84 ab	4.45 ab	4.77 ab	4.29 ab	5.21 ab	6.61 a

Note : Number in a row followed by the same letter showed insignificant according DMRT α=5%

Data were analyzed statistically. Significance was assessed through a one-way anova test. When *F* value was significant, Duncan Multiple Range Test was used to evaluate the differences between mean values of the treatments.

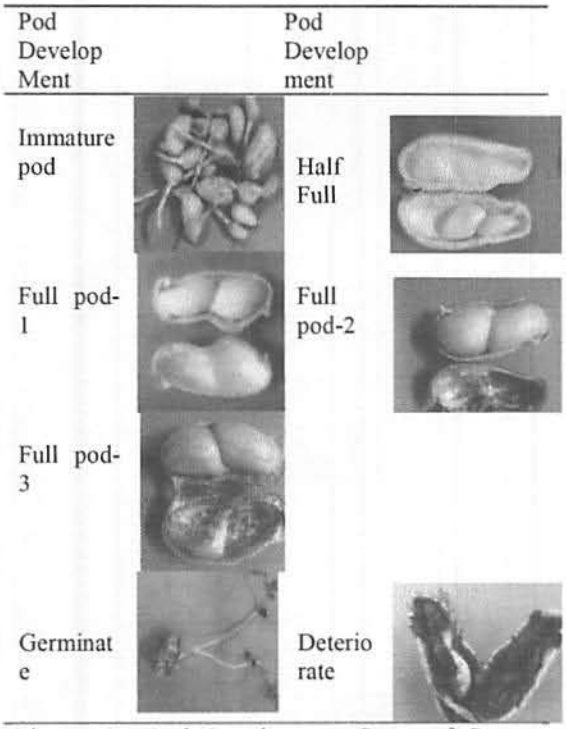
III. RESULTS AND DISCUSSION

Fifty percent of population flowering was reached by Kelinci at 26 DAP as accumulated daily heat unit 376.85 °Cd (degree heat unit), meanwhile Gajah and Jerapah at 27DAP as accumulated 391.20 °Cd. Gajah produced significantly higher full pod-2 (27,49%), as this pod stage is the best pod stage to harvest. More than 50 percent pod produced by Kelinci (54,78%) in form of immature pod. Higher number of full pod-3 was obtained at 105, 110 and 115 DAP, while full pod-2 at 90, 95 and 100DAP. Weight of dry pod/plant at 90, 95 and 100DAP was only slightly higher than 105,110 1nd 115DAP, on to make into consideration to choose time to harvest.

Since the result showed that there was no inter-action between variety and harvest time, analysis were done on data from each variety

A. Gajah

Gajah is a Spanish type of peanut. Total number of full pod stage 1, 2 and 3 were roughly 57% of total pod at each harvest time. Number of full pod stage 2 was the highest at 90 until100 DAP (Figure 1a). Number of immature and half full pod was relatively stable. It showed that the development of immature and half full pods were prevented during seed filling period. Few pod appeared had been germinated since first harvest but germinated pods significantly increase at 110 and 115 DAP. It appeared that the best time to harvest cv. Gajah was between 90 until 100 DAP. However, one has to consider that, although it did not show significant difference, the weight pod/plant tended to decrease with later harvest (Table 2). Nevertheless, for the best pod quality cv Gajah can be harvested at 90 and 100 DAP. Total daily heat unit accumulated at 90 and 100 DAP were 1346.35 and 1489.50 °Cd, respectively.



Picture 1 Pod Development Stage of Peanut (maturity stage appear in order from left to right and down)

B. Jerapah

Jerapah is also a Spanish type , but has more vigorous vegetative part and more number of pod/plant than cv. Gajah [3]. Flowering time and pod development pattern were the same as cv Gajah (Figure 1b). However the best time to harvest cv Jerapah was 90 DAP because at that time ratio between full pod stage 2 to total full pod stage 1, 2, 3 was the highest, and although insignificant number of immature pod and germinated pod were the lowest. Total daily heat unit accumulated at 90 DAP was 1346.35 °Cd.

Table 2 Dry pod weight/plant (gram) at various harvest time

Varieties	Harvest time (DAP)						
	85	90	95	100	105	110	115
	..... (g)						
Dry Pod Weight /plant	16.15 b	20.77 a	20.25 a	18.40 ab	20.05 a	18.21 ab	17.15 ab
Gajah	19.09	22.11	21.91	20.54	19.09	18.26	19.69
Jerapah	12.06	18.99	18.75	16.28	17.20	15.91	15.56
Kelinci	17.30 b	21.21 ab	20.10 ab	18.38 b	23.25 a	20.48 ab	17.65 b

Note : Number in a row followed by the same letter showed insignificant according DMRT α=5%

C. Kelinci

Kelinci is a Valencia-type with 2 - 4 kernels/pod, higher plant statute and lower number of branch [3]. The highest number of full pod stage-2 was reached at 90, 95 and 100 DAP, but the highest dry pod weight/plant was reached at 105 DAP (Table 2). Number of immature pod/plant was higher than that of full pod stage 1,2 and 3 at every harvest (Figure 1c). With dry pod weight/plant and pod quality to consider, cv Kelinci was better harvested at 105 DAP. Total degree days at 105 DAP was 1562.25 °Cd.

IV. CONCLUSION

The best harvest time was determined by the highest percentage of full pod stage 2 and dry pod weight per plant. Peanut cv Gajah was harvested best at 90 until 100 DAP, cv Jerapah at 90 DAP and cv Kelinci at 105 DAP. Total daily heat unit accumulated at 90 , 100 and 105 were 1346.35, 1489.50 and 1562.25 °Cd, respectively.

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