EFFECTS OF FIVE SEASONS IN TWO YEARS PADDY PLANTING PROGRAMME ON SOIL BEARING CAPACITY

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ABSTRACT

Rice is the staple food of Malaysian society and this industry is considered as strategic and has been receiving special attention from the government. It is an important commodity in the national food security agenda. In order to produce smooth rice cultivation, certain conditions and requirements must be strictly adhered. One of the main requirements is to develop a soil

bearing capacity more than 3.0 kg/cm^2 in paddy field to support mechanization through suitable drainage system. In this research, the project focused more on the impact of the soil bearing capacity due to continues planting within 2 years by using standard operation of machineries. Data retrieval started from season 1 until season 5. Data was recorded on May 29, 2015 until May 09, 2017. For this study, the number of data retrieval per season is 3 @ 4 times per season, and the period of data collection was before planting, while planting and post planting. The project was conducted in Sawah Sempadan, IADA Barat Laut Selangor. Based on the analysis, it was found that soil bearing capacity still had 0.3 MPa despite the decreasing soil strength. The percentage of decline is within 20 percent to 27 percent measured at a depth of 30 cm from the ground surface to take account of the economic machinery trafficability, and occurred between Season1 to Season 2 and Season 3 to Season 4.

Keywords: Rice, soil bearing capacity, mechanization and trafficability

INTRODUCTION

In 2010, there were 673,745 hectares of rice fields in Malaysia, where more than 50% have been planted in eight rice granary area in Peninsular Malaysia, 32.3% outside of rice granary area and the remaining 10.4% represent of high land paddy, especially in Sabah and Sarawak. National Food Security Policy aims to increase Self Sufficient Level (SSL) level for local rice production from 70% in 2010 to 85% in the year 2015. This will reduce the percent of importing rice from 30% to 15%. One of the alternatives was by continuous planting by 5 times in 2 years. Thus it will increase the rice yield production.

On the other hands, trafficability is the basis for efficient farming, especially when it comes to land preparation and harvesting. In general, good trafficability is the ability of the land to accommodate the load of the machinery. Therefore, soil strength is important to bear the burden of machinery without damaging the basic structure. The hardness of the hard layer of soil or hardpan layer must have at least 3 kg / cm^2 at a depth of 30 cm, which is very important to accommodate heavy field machinery. Therefore, this study is very important in helping the government to evaluate the true potential of rice cultivation five seasons within two years to ensure sufficient rice supply to meet its growing demands and also to take account of the trafficability of machinery in paddy fields.

RESEARCH AREA

The study was conducted in IADA Barat Laut Territory in Sawah Sempadan, Kuala Selangor, Selangor. The total planted area was 203.4 hectares and the blocks that had been identified as case studies were Block D2, Block K2, Block P2 and Block V. The irrigation source is from TAS5, which is from Kuala Selangor River as shown in Figure 1.

Figure 1: Water source from TAS5, Kuala Selangor River and irrigation system for planted project area

RESEARCH METHODOLOGY

In this study, the tests were conducted by using Penetrologger to get the soil strength or soil bearing capacity. These measurements get through by penetration into the soil at the field and stored automatically in the instruments. After finished collecting the data, it is transfered to the computer for analysis. Software *Penetrologger viewer* and *Surfer* as well as *Microsoft Excel* were used for the purpose of analysing the data obtained. To gather the data, the procedures were as follows:

i. Site visit,
ii. Selection and determination of study plots,
iii. Study boundaries,
iv. Planting scheduling,
v. Survey boundary measurements,
vi. Grid determination and layout preparation for each study plot,
vii. Sampling reading, and
viii. Data analysed

A total number of 8 points of penetration per plot was determined in a grid of 50 metres x 50 metres with 3 - 5 metres distance from ditches or farm roads as shown in Figure 2. Three penetrations or readings taken within a radius of 1 metres for every point. The total penetrations are 24 times / plot. For this analysis, five blocks were selected namely Block D2, Block K2, Block P2, Block V (experimental plot) and Block K1 (control plot). The total numbers of plots are 20; 6 plots for D2, 4 plots for K2, 4 plots for P2, 2 plots for V and last Block K1 with 4 plots. The total number of data retrieval is 480 times.

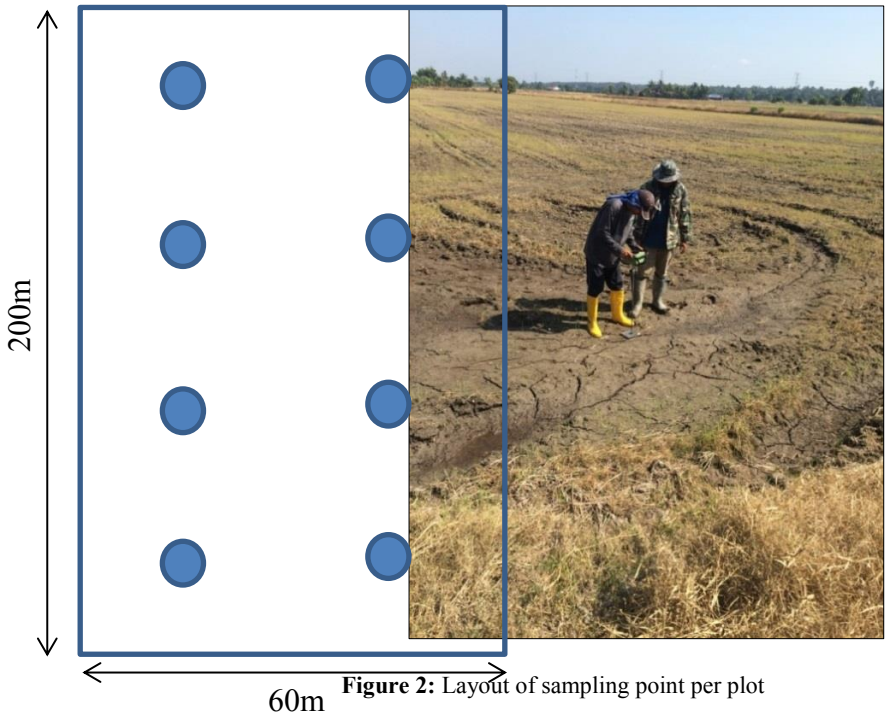
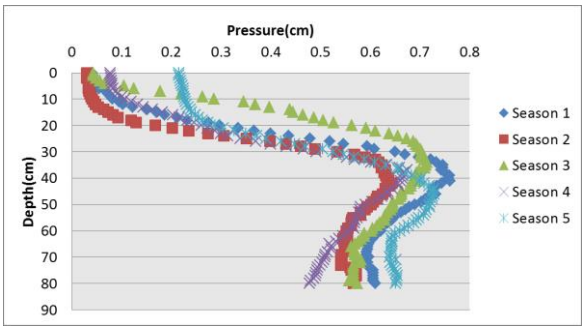


Figure 2: Layout of sampling point per plot

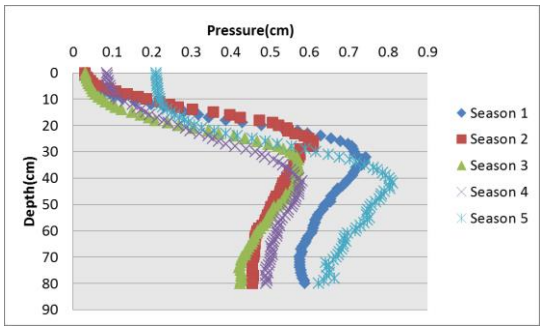
RESULTS AND DISCUSSIONS

Soil bearing capacity readings were measured from ground surface, 0 cm to 80 cm into the soil depth. The value of this reading is also closely related to the movement of rice machinery (Kaname *et al*., 1976). Studies showed that 3 kg /cm^2 - 4 kg /cm^2 (0.3 MPa - 0.4 MPa) as deep as 0 cm - 20 cm from the ground surface is needed to facilitate the movement of machinery. For the analysis of this study, soil strength reading at depth of 30 cm from ground surface was taken to be used as a guide to see the suitability of machinery trafficability to perform work in the field. This is also to be used as a reference source for economic machinery movements. (Ayob *et al*., 1990).

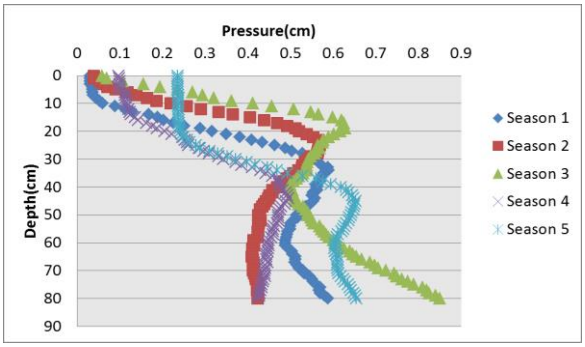
The analyses of soil bearing capacity for early stage before planting were illustrated in Figure 3. Every block showed the same trend of the soil strength. From ground surface to the 15 cm, the soil strength kept increasing gradually, and then kept increasing rapidly to the depth of 40 cm. After certain depth, the soil strength decreased gradually to the soil depth. Same pattern of the soil strength occurred for the stage of after harvesting, which illustrated in Figure 4. Based on previous researchers, the report stated that the depth of 30cm from surface level was important for crop rooting and machinery movement. This layer must be well maintained and care properly to utilise for the long term of rice planting. Based on Figure 3 and Figure 4, the soil bearing capacity still had the 0.3MPa at the depth of 30 cm, despite the occurrence of increasing and decreasing of the soil strength from Season 1 till Season 5.



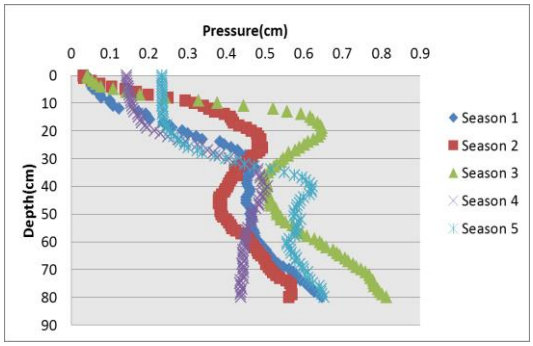
(i) Block D2



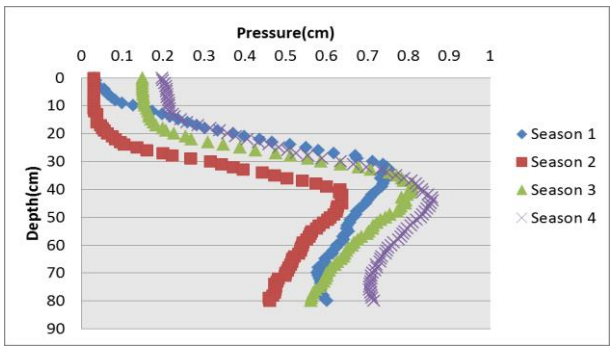
(ii) Block K2



(iii) Block P2

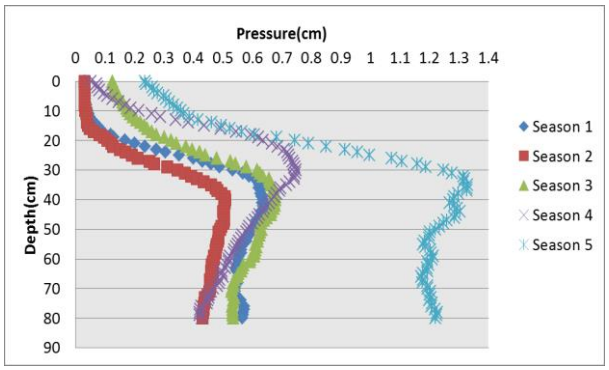


(iv) Block V

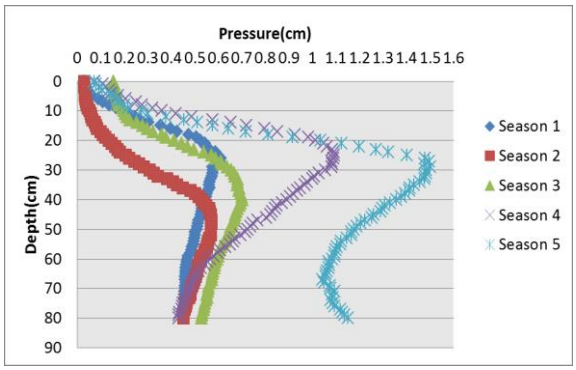


(v) Block K1

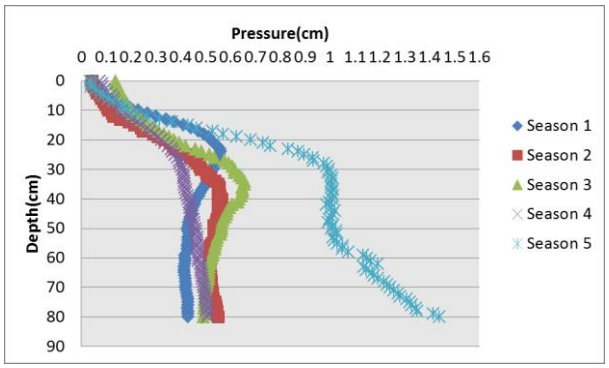
Figure 3: Soil bearing capacity for each Block at stage before planting



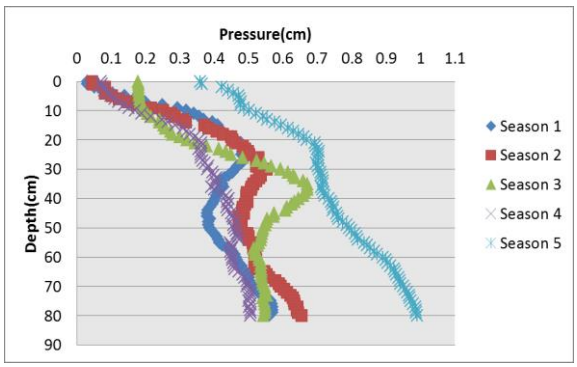
(i) Block D2



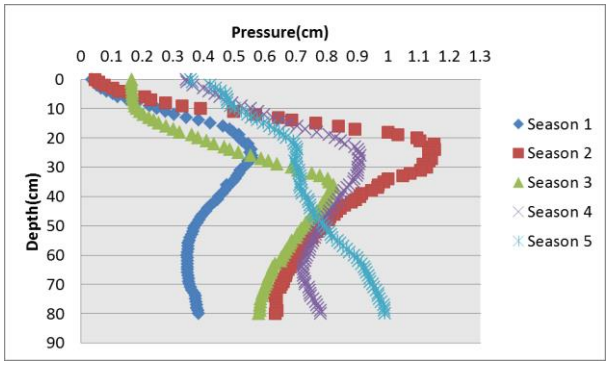
(ii) Block K2



(iii) Block P2



(iv) Block V



(v) Block K1

Figure 4: Soil bearing capacity for each block at stage after harvesting

Table 1 showed the percentage of increasing and decreasing of soil strength between each seasons before planting and after harvesting. The highest of decreasing in soil strength was 27 percent at Block K2. Based on this analysis, it was found that all the plots had the maximum reduction from the Season 3 to the Season 4 except for Block K2 (8.82 percent) in before planting period. Meanwhile for after harvesting period, the maximum reduction is from Season 1 to the Season 2 except for Block V (9.19 percent). It is found that the soil bearing capacity had negative percentage of reduction for most of all blocks from Season 1 to Season 2, and Season 3 to Season 4, and positive percentage of increment from Season 2 to Season 3 and Season 4 to Season 5. The reduction will occur again to the next season if the planting operation is continued, and eventually will damage the *harpan* layer, by slowly lowering the soil strength and changing the soil structure. These were influenced by the weather factors and the farm management itself, and also the continuous paddy planting which had an only short break.

Table 1: Difference of percentage of soil strength between seasons

Season	Different (%) Before planting				Different (%) After harvesting			
	D2	K2	P2	V	D2	K2	P2	V
1-2	-11.71	-13.78	-1.87	-0.31	-18.77	-27.0	-4.88	9.19
2-3	17.08	-2.59	0.12	8.62	26.96	34.7	13.66	4.00
3-4	-21.36	-8.82	-19.92	-13.92	13.19	40.1	-20.99	-21.31
4-5	3.52	15.45	2.85	-0.83	49.98	43.0	58.81	32.56

*(symbol (-) = decreasing))

CONCLUSION

Assessments of soil strength for rice cultivation for 5 seasons in 2 years were clearly presented. Based on the analysis, the soil strength is dropped within 20 percent to 27 percent at depth of 30 cm from the ground surface. It is occurred between Season 1 to Season 2, and Season 3 to Season 4. It seems that the implementation of continuing planting is need to be revised. Many factors need to take into consideration such as the climate prediction, pest & diseases management, planting scheduling, irrigation and drainage system availability, mechanization involvement and farmers effort to contribute to improve the rice yield of Nation need. The government need to revised the rice subsidies and policy if the implementation continued

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