

## PENERAPAN ANALISIS DIMENSI PADA RANCANGBANGUN PROTOTYPE ALAT TANAM PADI DENGAN MEKANISME GESER UNTUK POLA TANAM TAPAK MACAN

### ABSTRAK

Penelitian ini bertujuan merancang dan memodelkan alat tanam padi untuk penanaman pola tapak macan. Rancangan yang dibuat didasarkan pada alat tanam padi semi mekanis model jajar legowo dengan pendekatan *reverse engineering*. Model yang diteliti adalah prediksi performa pengambilan bibit dan performa pembentukan pola tapak macan dengan menggunakan penerapan analisis dimensi berdasarkan variabel rancangbangun dan operasionalnya. Model prediksi pengambilan bibit dipilih karena salah satu syarat tanam pola tapak macan yaitu dalam satu titik tanam terdiri dari satu batang bibit. Model performa pembentukan pola dipilih karena pada penerapan pola tapak macan, jarak bibit yang tertanam dalam satu rumpun memiliki jarak antar batang 5-7cm dengan bentuk segitiga. Variabel untuk pengembangan model performa pengambilan bibit adalah penahan bukaan bawah ( $s$ ), konstanta pegas garpu tanam ( $kgt$ ), pergeseran *tray* bibit ( $pt$ ), diameter batang ( $x$ ), dan rata-rata jumlah bibit terambil ( $n$ ). Model performa pembentukan pola dikembangkan dari variabel konstanta pegas mekanisme ( $kpm$ ), konstanta pegas *stopper* ( $kps$ ), toleransi tali bergeser ( $t$ ), dan berat bibit ( $w$ ), dan pergeseran titik ( $p$ ). Setelah pengujian performa dilakukan, diperoleh hasil persamaan matematis performa pengambilan bibit yaitu  $n = 10^{1,445} \left\{ \left( \frac{pt}{x} \right)^{1,539}, \left( \frac{s}{x} \right)^{-1,913} \right\}$ . Untuk persamaan matematis performa pembentukan pola persamaan yang diperoleh yaitu  $\frac{x}{t} = 10^{0,722} \left\{ \left( \frac{KPM}{KPS} \right)^{0,572} \right\}$ . Pada pengujian performa pengambilan bibit, hasil terbaik yang diperoleh yaitu rata-rata jumlah bibit terambil sebanyak 1,2 batang. Hasil pengujian performa pembentukan pola diperoleh hasil penggunaan mekanisme geser tidak menurunkan kemampuan alat dalam membentuk pola tapak macan. Model performa pengambilan bibit telah berhasil menjelaskan 84,82% hasil pengambilan bibit yang dan sebanyak 15,18% lainnya dijelaskan oleh performa operator. Untuk performa pembentukan pola sebanyak 74,3% hasil yang diperoleh telah dapat dijelaskan dan 25,7% sisanya dijelaskan oleh performa operator. Hasil analisis variabel yang paling berpengaruh terhadap performa pengambilan bibit adalah  $\pi_3 \left( \frac{s}{x} \right)$  yaitu setiap perubahan  $\pi_3$  sebesar 10%, maka  $\pi_1 (n)$  akan mengalami perubahan sebesar 329%. Pada analisis variabel yang paling berpengaruh pada performa pembentukan pola adalah  $\pi_2 \left( \frac{KPM}{KPS} \right)$  yaitu setiap mengalami perubahan 10% akan mempengaruhi  $\pi_1 \left( \frac{x}{t} \right)$  sebesar 2%.

Kata kunci: Alat tanam padi, sistem tanam padi tapak macan, analisis dimensi

## APPLICATION OF DIMENSIONAL ANALYSIS TO THE DESIGN OF THE PROTOTYPE RICE PLANTING TOOL WITH SLIDING MECHANISM FOR "TAPAK MACAN" CROPPING PATTERN

### ABSTRACT

This study aims to design and model the prototype rice planting tool with sliding mechanism for "tapak macan" cropping pattern. The design is based on a semi-mechanical rice planting tool with a reverse engineering approach. The model studied is a prediction of seedling picking performance and "tapak macan" pattern creation performance using a dimensional analysis approach based on design and operational variables. The prediction model of seedling picking performance was chosen because one of the conditions for planting a "tapak macan" pattern is that the number of embedded seedlings is one stem. The performance model of pattern creation was chosen because, in the application of the "tapak macan" pattern, the distance of the embedded seedlings is in the range of 5-7cm with a triangular shape. Variables for the development of seedling picking performance models are lower opening retainer (s), planting fork spring constant (kgt), seedling tray shift (pt), stem diameter (x), and the average of seedlings taken (n). The pattern formation performance model developed from the variables of mechanism spring constant (kpm), stopper spring constant (kps), shift rope tolerance (t), seedling weight (w), and point shift (p). After the performance test was carried out, the results of the performance seedling picking mathematical equations obtained are  $n = 10^{1.445} \left\{ \left( \frac{pt}{x} \right)^{1.539}, \left( \frac{s}{x} \right)^{-1.913} \right\}$ . And then the mathematical equation that was obtained for the performance model of pattern creation is  $\frac{x}{w \times t} = 10^{0.722} \left\{ \left( \frac{KPM}{KPS} \right)^{0.572} \right\}$ . From testing seedling picking performance for the prototype of rice planting tools for "tapak macan" patterns with a sliding mechanism, the best results obtained average results as much as 1.2 stems. For the results of testing the performance of pattern creation, the results of the use of a sliding mechanism have the same ability of the previous prototipe to form a "tapak macan" pattern. For the model of the seedling picking performance, has successfully explained 84.82% of the seed picked results and another 15.18% is explained by operator performance. For the model of the pattern creation performance as much as 74.3% of the results to be obtained can be explained and the remaining 25.7% is explained by operator performance. The result of the variable analysis that most affects the performance of picking seedlings is  $\pi_3 \left( \frac{s}{x} \right)$ , that is, if  $\pi_3$  changes by 10%, then  $\pi_1$  (n) will experience a change of 329%. For pattern formation performance, the  $\pi_2 \left( \frac{KPM}{KPS} \right)$  variable every 10% change will affect the pattern creation performance  $\pi_1 \left( \frac{x}{t} \right)$  by 2%.

**Keywords:** Rice planting tool, "tapak macan" rice planting system, dimensional analysis