Journal of Agricultural Machinery
Vol. 6, No. 2, Fall - Winter 2016, p. 537-546

نشریه ماشین‌های کشاورزی
جلد ۶، شماره ۲، نیمسال دوم ۱۳۹۵، ص ۵۴۶-۵۳۷

Predicting working days for secondary tillage and planting operation in fall

A. Kosari Moghaddam[1]- H. Sadrnia[2*]- H. Aghel[2]- M. Bannayan Aval[3]

Received: 06-08-2014
Accepted: 07-12-2014

Introduction

The working day is an important component in selection and analysis of farm machinery systems. The number of working days is affected by various factors such as climate, soil characteristics and type of operation. Daily soil moisture models based on weather long-term data and soil characteristics were almost used for calculating probability of working days. The goal of this study was to develop a simulation model to predict the number of working days for secondary tillage and planting operation in fall at 50, 80 and 90% probability levels.

Materials and Methods

A simulation model was developed using 21 years weather data and soil characteristics for calculate daily soil moisture content in Research Station of Ferdowsi University of Mashhad. So soil moisture was calculated using daily soil water equation for top 25 centimeter of soil depth. Moisture equal or lower than 85% of soil field capacity and precipitation lower than 4 millimeter (local data) were considered as soil workability criteria. Then the working days were determined for secondary tillage and planting operation at 50, 80 and 90% probability levels in falls. The number of days at 50% probability was the mean over 21 years and the number of days at 80% and 90% were determined for each two weeks period as the average number of working days minus the product of t value and standard deviation of those numbers.

Model Evaluation

Evaluation of model included a comparison of predicted and the observed the number of working days in Research Station of Ferdowsi University of Mashhad during 2002-2010 and sensitivity analysis was implemented to test the effect of changes in soil workability criterion (80, 90, 95 and 100% of soil field capacity), drainage coefficient (25 % decrease and increase) and soil field capacity (40% increase) on simulation results.

Results and Discussion

Comparison of predicted and observed days showed that correlation coefficient was 0.998 and the difference between the simulated data and observed data was not significant at the 5% level.

Results from sensitivity analysis in Table 3 showed that when soil workability, drainage coefficient and field capacity increased, the number of working days increased, but model sensitivity was very low to drainage coefficient and soil field capacity. In general, the most important factor is precipitation in this weather conditions.

The number of working days for secondary tillage and planting operation for each period in fall are shown in Table 4.

Conclusions

A simulation model was developed for predicting the number of working days for secondary tillage and planting operation in fall. This model was based on weather long-term data and soil characteristics for the Research Station of Ferdowsi University of Mashhad. The most important factor was precipitation and the model had low sensitivity to drainage coefficient and soil field capacity. The number of working days in 50%, 80% and 90% probability levels for period of ten days was on average 9.94, 9.21, 8.57 days for 23th September to 22th October and 9.77, 8.02, 6.41 days for 23th October to 21th November and 9.68, 7.48 and 5.24 for 22th November

1- Graduated Student, Agricultural Mechanization Engineering, Department of Biosystems Engineering, Ferdowsi University of Mashhad
2- Associate Professor, Department of Biosystems Engineering, Faculty of Agriculture, Ferdowsi University of Mashhad
3- Associate Professor, Department of Agronomy, Faculty of Agriculture, Ferdowsi University of Mashhad
(*-Corresponding Author Email: hassan.sadrnia@um.ac.ir)

to 21th December, respectively.

Keywords: Modeling, Planting, Secondary tillage, Workability, Working days