Preventive Maintenance in Agricultural Machinery

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Abstract

The main purpose of this study is to investigate the possibilities and suggesting the establishment of the preventive maintenance methods in agricultural projects and stating the damages encounter due to lack of a comprehensive method of maintenance and repair. To study the effect of preventive maintenance on lag period, cost, basic repairment and time of accomplishing project, an experiment was conducted at Baghain, Iran. In 1st year the efficiency of a 3 share Moldboard plow, one disk and one roller without preventive maintenance function and in 2nd year the same experiment but with preventive maintenance function were investigated. Based on the outcomes obtained by this research, using preventive maintenance engineering methods resulted in the reduction of lag period and expense by 48% and 84% respectively and efficiency rate the machine was increased 1.2 fold.

Keywords*: Agricultural Machine, Down Time, Efficiency, Preventive Maintenance*

1 Introduction

Severe competition along with growing advance technology resulted in high variation in industry prospective crops, methods, Processing and new systems are consistently invented and employed. Therefore by using proper programming we should promote the efficiency equipments in spite of high costs and personal a remarkable challenge exist to reduce. The cost while enhance production and its essential for our economy. In general, maintenance may be divided in 2 categories: Corrective and preventive maintenance [3,5]. Corrective maintenance is a kind of repair which happens after destruction of the system and its goal is to prevent the further outcomes resulted from destruction [1]. Preventive maintenance is a kind of repairment that we should do prior to destruction of the system and its goal is to maintain the system in a specific situation. This case involves proper inspection, identification and so prevention of destruction. Preventive maintenance itself divided in 3 subcategories. Time based maintenance (TBM), Condition based maintenance (CBM) and predictive maintenance (PM).

1.1 *Normal distribution of destruction in preventive methods*

In preventive maintenance of changing some tools carrying out after specific period to prevent destruction. To estimate the longevity of machine statistic is being employed. In this method one variable is considered randomly and distribution of the number of time based destructions shown as normal distribution in Figure 1. As a result the time

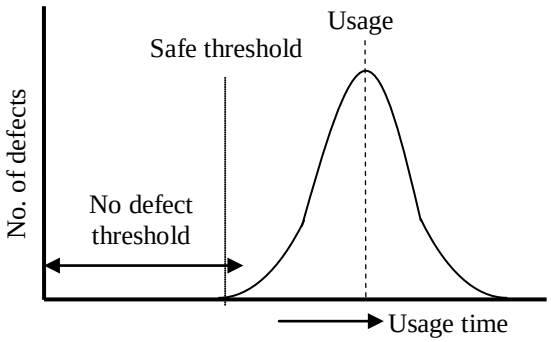

Figure1: Bell shape curve of defects in usage time of machine

course between repairment is identified based on normal distribution curve .This is a bell shape curve which is bilaterally systematical. The surface under the curve is equal to 1 another word it explain 100% outcomes due to distribution. The curve or function is called probability distribution density curve [3]. Theoretically the curve has tendency toward infinity at both end. Risk rate is the momentum rate of Failure, another word the probability between t and t+dt where is shown there were no failure the time of t .They show it as the following Equation:

$$h(t) = \frac{f(t)}{1 - F(t)} \quad (1)$$

In this formula $f(t)$ is the function of density and $F(t)$ is the function of failure distribution.

2 Materials and methods

The experiment was performed at Baghain 25 Km away from Kerman, Iran, with annual precipitation of 180mm and Maximum and minimum absolute temp. of 41 $^{\circ}$C and -5 $^{\circ}$C. The Physico-chemical property of soil is shown on Table 1. The experiment was conducted it 2 phases.

2.1 *Phase1*

The 2 sided mold board plow with 3 shine was connected to three points hitch of MF285 tractor and level moldboard considering daily time consuming and volume of treated soil by moldboard with and without preventive maintenance the amount width and depth of soil disturbance was determined .The collected data was compared with 3 month data provided in programming and control of project by the company (Table 2).

Table1: Soil physico- chemical properties of experimental site

Soil depth(cm)	TN(ppm)	N-inorganic	Soil texture	PH
0-50	585	18.6	Clay loam	6.9
50-100	615	1.5	Clay loam	7.4

Table 2: Treated soil volume by moldboard plow in different positions

Day	Working hr.	Volume of treatments		
		Forecasted volume (m^3)	Volume in normal position (m^3)	Volume using NT preventive (m^3)
1	2	850	310	360
2	4	1600	610	650
3	6	2500	1250	1400
4	8	3500	1600	2100
5	10	4200	2650	2950
6	11	5000	3200	3500
7	12	5800	3750	4550

Table 3: Treated Soil volume by discoed roller in different position

Day	Working hr.	Volume of treatments		
		Forecasted volume (m^3)	Volume in normal position (m^3)	Volume using NT preventive(m^3)
1	2	1900	1300	1600
2	4	3850	2000	3250
3	6	5600	3200	4750
4	8	7550	4450	6000
5	10	9650	4560	5830
6	11	11500	5250	7650
7	12	12500	7650	9350

2.2 *Phase2*

In this phase machines included of disk and roller was connected to MF285 using the same method in phase 1. In cultural practice after disk the roller was applied, and since work condition and amount of treated soil via disk and roller considered equally, the appropriate data reform in Table 3.

The volume of treated soil parameter per time is a criterion of efficacy of the system and its availability. In all stages the depth and work condition (speed, kind of tractor and soil condition) considered similar. In order to do visual rating in this project after performing introductory rating and using repeatedly a check sample, 10 technician with high accuracy in realizing the similar test were selected to do visual rating, finally 7days data collection were processed via excel software.

3 Result and discussion

The preliminary result showed that in using Preventive maintenance the amount of disturbed soils are loser to predictive value and the difference between preventive maintenance and predictive value were reduced remarkably it was recognized that in using preventive maintenance up to the final day of experiment , the reduction trend was continued. Figure. 2, Figure 3. The most effective in moldboard efficiency and output are sharpness of blade, proper adjustment of depth, and having enough cutting pin. By using preventive maintenance such as matters were inspected to prevent the time of shutdown system.

Among effective factor in disc efficiency are the presence of proper Ball bearing sharpness and healthy disc rollers. Proper adjustment of depth before inspection and in order to reduce preventive the disc shutdown the spare parts should be available for the text, using preventive maintenance, regular inspection of mobile parts and Ball bearing. Plus lubrication was down effectively and by changing Ball bearing on time we could prevent the roller malfunction during working days which resulted in saving time and money. In this research the best characters coefficient were evaluated to estimate preventive maintenance acceptance using multivariate and the following equation was obtained.

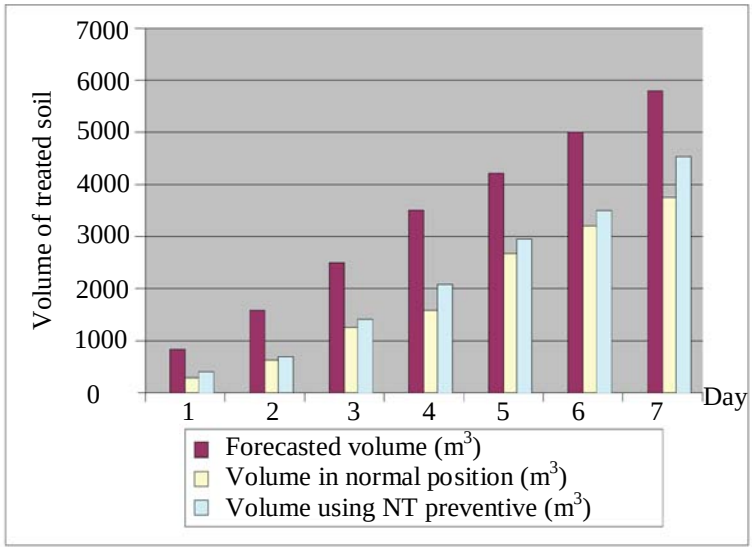

Figure 2:

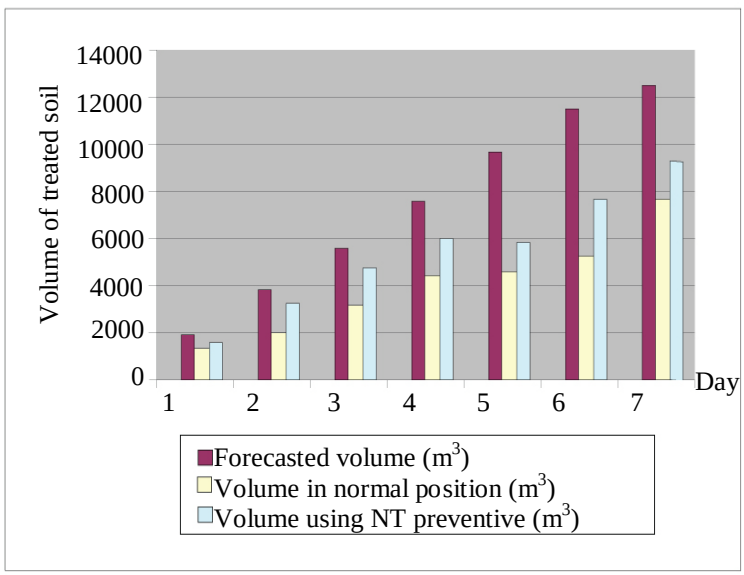

Figure 3:

$Y = 0.67X_1 + 0.451\ X_2 + 0.25X_3$

In which

y=the rate of preventive maintenance acceptance

X_1 =the total cost

X_2 =the total time drop off

X_3 =the time of doing project

Considering the above equation we may conclude that cost factor has the main effect in overall acceptance and in order to use preventive maintenance we should notice the factors involve in total cost. Considering the results of phase 1 the reduction of 48% and 84% were obtained during shutoff and repair cost respectively and the addition of 1.2 fold was obtained in benefit Table 4,Table 5.

Table 4: Repair costs, Waste time and mold board efficiency in two positions of normal and NT preventive use

Normal use			NT preventive use		
Repair costs(Rial)	Waste time(hr)	Efficiency(%)	Repair costs(Rial)	Waste time(hr)	Efficiency(%)
7120000	60	65.3	6000000	32	77.5

Table 5: Repair costs, Waste time and disk and roller efficiency in two positions of normal and NT preventive use

Normal use			NT preventive use		
Repair costs(Rial)	Waste time(hr)	Efficiency(%)	Repair costs(Rial)	Waste time(hr)	Efficiency(%)
45000000	400	58	28000000	240	70

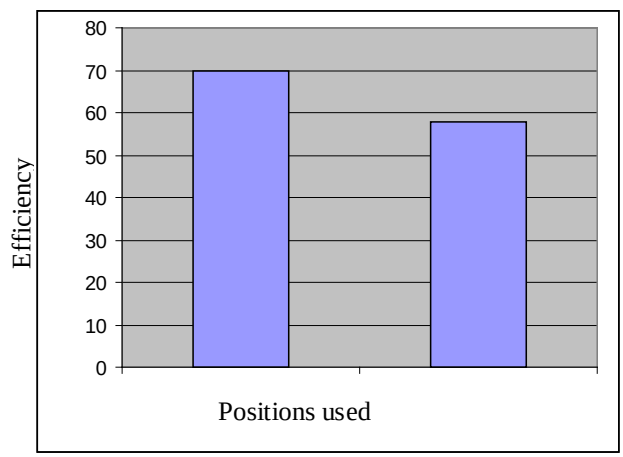

Figure 4: Efficiency in two positions of normal and NT preventive use in first phase

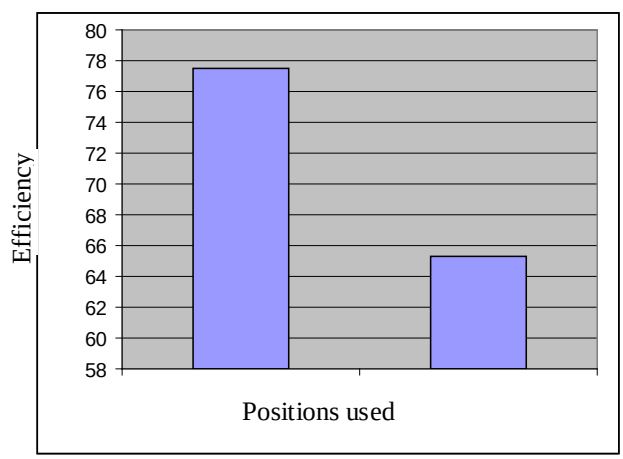

Figure 5: Efficiency in two positions of normal and NT preventive use in Second phase

The results showed that the effect of preventive maintenance is very effective and has pronounced effect on repairment and time. Comparing the cost of traditional situation and preventive maintenance in both phase in other part of the world also indicated that by employing preventive maintenance the level of efficacy of instrument improve effectively. The result also indicates that as time passes, preventive maintenance will have the advantage of effectiveness, efficacy and longevity of the system that we mentioned in introduction. The least and most point require to 1st and last days respectively. Figures 4 and 5 showed that efficiency of preventive maintenance is better than traditional system. The statistic of reduction of repairment cost in care of preventive also indicate that employing an effective program resulted in reduction of direct and indirect which is indicated by Darabi also considering the result of this project indicates, that by preventive maintenance time lost and repair cost reduce, and the efficacy of machine increase. Using this project causes that technological damage which contributes to a great degree. To the pivot of preventive maintenance were reduced and by using not too much cost the efficacy of equipments increase. The results of this paper agree with findings of Khodabakhshian, 2008 and Darabi, 2002.

4 Conclusion

Improvement of agricultural machinery and advance technology during this part decades resulted in reduction of Labor Cost in project. Agriculture in Iran has its developmental trend and has to compete with big companies in near Future. The managers should be prepared to get along with modern system of management including maintenance and repairment in order to compete with others based on

References

[1] Bateman J., 1995. Stand alone manufacturing compared with cellular manufacturing industrial management, *International Conference on Preventive Maintenance*, Canada.

[2] Darabi Y., 2002. The usage of Condition monitoring to approve maintenance program of farm machinery, I*nternational Conference on agricultural machinery*, Kerman, Iran.

[3] Kertics R., 2003. Effective Maintenance Planing and Scheduling, *Carolina Plant Engineering and Maintenance Conference*, Florida.

[4] Khodabakhshian R., M Shakeri. and J. Motie., 2008. Condition monitoring of agricultural machinery, *5th International conference on maintenance*, Tehran, Iran.

[5] Li J. and L Khoo, 2006 Generation of posit multiple Components disassembly sequence for maintenance using a disassembly constraints graph, *International Journal Production Economics*, 102: 51-65.