

## TEST RESULTS FOR MACHINE AND HUMAN HOURS SPENT PRODUCING DIFFERENT GRAPE VARIETIES

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### Abstract

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In the production of grapes, no matter which variety works arise expenditure of machine and human work hours in the performance of certain work processes. Expenditure occurs from early vegetation year, until its end and is different depending on the production technology applied by staffing with drive and attaching machines, but the variety and the type, duration of vegetation period to harvest, but also from the yield. Always there was a tendency agriculture staffed with adequate (adequate propulsion machinery and trailers in order certain work processes to be mechanized or half mechanized and designed work-flows to perform faster, better and more economical. Significance of these tests can be seen in the fact that after years in our country and in developed countries there is a lack of human labor, as the performance of those business processes that do not need expertise, but also in those work processes requiring trained staff. This issue will continue to be current; exactly these trials will make a meaningful contribution to depict current state, but also the need for engaging people per hectare area for different grape varieties, timely execution of work processes. It is this tendency and trend follow and factories manufacturers of this type of machines each year on the market offering new technical solutions that can ease their work and better to perform with the application of a new production technology that will give quality and quantity of production.

*Key words:* machine hours, human hours, grape varieties

### Introduction

#### Objective examination

As an immediate goal in the investigation was to analyze the existing production technology that covers all business processes in the manufacturing conditions and to examine the expenditure machine hour's drive and attaching machines, human hours (service machine) and working hours that performed manually, in order to recognize expenditure hectare area to be agronomists to take measures for their fully equip with machinery or half mechanized.

The aim was to perform recording in which the work processes as required machine and human work hours for different varieties, taking into account their growing season and taking into account whether grape for making wine or grape for consuming. Such recordings will fully accomplish the goal not only for the duration of their execution, but the necessity of timely deployment of labor and timely planning funds for their execution. Such recordings aim to give a clear

“picture” that follows downloadable measures for rationalization and procurement of new equipment and machinery.

#### Area and test object

The tests were carried out in farm production conditions in near Radovich, row system cultivation of grape plants. The tests included varieties, Cardinal, Kratosija, Afus ali total area of 140 ha. Plantation is 18 years old, and all tests were performed in the production year 2009/2010. The study involved the overall available mechanization with all power and attaching machines, which were included in the regular performance of workflows in production technology. Row system was at a distance 2.7x1.5 all present varieties.

### Materials and Methods

To accomplish the goals of the tests and to see the significance of the results obtained were applied standard methods of scientific research work in the manufacturing conditions in

agricultural mechanization. In tests dealt three grape varieties grown in intensive plantation and Afus Ali, later arrived variety Cardinal as soon arrived, and the wine we took grape Kratoshija. The total area which conducted trials included a total of 84 acres.

The tests were conducted at the beginning of February until the end of October and were recorded by the methods chorography in all work processes by the use of machinery, hiring people with machine half mechanized and manual work processes with expenditure classes' hectare area. Recording was made after their manner of organization of work and their norms when using the drive and plug machines. When wine variety Kratosija stage vintage recording was done single phase harvest and during grape for consumption varieties was recorded workflow harvesting and packaging market as well as the rest during harvest grapes for processing.

The results were put in the work tables with 5 times iterations in this case were not taken into account repetitions at a certain time, but repeat run after the working day following the above methods.

## Results and Discussion

The results of two years of testing in production conditions gave us interesting data are shown in the four tables. From the review of the results shows that in the production conditions for each variety expenditure of machine and human work hours is different. If you establish a common view of such results can be illustrated that the same variety in different years expenditure of working hours is not the same,

which is due to the fact if regularly applied to all work processes or some omitted during vegetation and what is the yield per hectare area, because certain varieties each year does not give the same yield, and thus in certain work processes expenditure hours (of machines and people) (Oplanic et al., 2011) is the same throughout the tests we noticed that the weather conditions have influence, but do not take into account those parameters affecting primarily vegetation stages, of which depend on the engagement of working hours.

Regular work processes of the three tested cultivars are shown in Tables 1, 2 and 3 - the results obtained for the expenditure of machine and human work hours (machine service) as well as the average results of the two trials.

It is noticeable from the three tables that occurs Deviations annual expenditure of machine and human work hours hectare area, which is due as a result of the number of work processes carried out during the year, yields, and weather conditions in respect annual precipitation is noticeable in 2010 where cultivation is done one more due to the heavy rainfall and the occurrence of weeds. If we analyze the results tabular, average values obtained in wine varieties shown in Table 1, the average hectare area spent 42.17 machine hours and 63.75 human hours that accounted service machine.

It is noticeable from the given tables that the use of herbicides, spending hours of human labor hours in wine varieties accounted for 6.63 in Afus Ali 5.83, and in the variety Cardinal 4.25. This is due to the fact that spray herbicides running with two workers and the machine must move very slowly, and by the results show that machine hours show value around 2.5 hours per hectare surface. Was often hired another work-

**Table 1**  
**Results of the examination expenditure of machine and human work hours (service machines) per hectare area of wine grape varieties**

Work processes	2009				2010				Average			
	Machine hours, h	Percent, %	Human working hours, h	Percent, %	Machine hours, h	Percent, %	human working hours, h	Percent, %	machine hours, h	Percent, %	human working hours, h	Percent, %
Relocation of tendrils from row	2.18	6.47	2.27	3.94	2.14	4.23	2.3	3.29	2.16	5.35	2.29	3.62
Cure tendrils from trails	0.92	2.73	0.96	1.67	0.9	1.78	0.95	1.36	0.91	2.25	0.96	1.51
fertilization	0.87	2.58	1.88	3.26	0.86	1.7	2.28	3.26	0.87	2.14	2.08	3.26
Plowing cultivation	9.39	27.86	9.97	17.3	10.4	20.55	12.2	17.46	9.9	24.2	11.09	17.38
spraying	4.45	13.2	6.32	10.97	4.5	8.89	7.48	10.7	4.48	11.05	6.9	10.84
herbicides	2.1	6.23	6.02	10.45	2.6	5.14	7.23	10.35	2.35	5.68	6.63	10.4
dusting	0.3	0.89	0.8	1.39	0.32	0.63	0.94	1.35	0.31	0.76	0.87	1.37
Transportation	13.5	40.05	29.4	51.02	28.9	57.09	36.5	52.23	21.2	48.57	32.95	51.63
Total	33.71	100	57.62	100	50.62	100	69.88	100	42.17	100	63.75	100

er making the solution and therefore in the table recording expenditure this workflow from 6.63 in wine varieties, 5.83 in variety Afus Ali and 4.25 in the variety Cardinal.

But in variety Cardinal was used only one application. General speaking after varieties machine working hours

showed the greatest results in a variety Afus Ali from 47.46 (Table 2), which is due to its later harvest, which requires an application more than variety cardinal, where the average value of machine hours spent was 39.75 hours. If we analyze the average values obtained in Tables 1, 2

**Table 2**  
**Results of the examination expenditure of machine and human work hours per hectare area variety Afu Sali**

Work processes	2009				2010				Average			
	machine hours, h	Percent, %	human working hours, h	Percent, %	machine hours, h	Percent, %	human working hours, h	Percent, %	machine hours, h	Percent, %	human working hours, h	Percent, %
Relocation of tendrils from row	2.18	6.42	2.23	3.57	2.05	3.36	1.98	2.87	2.12	4.89	2.11	3.22
Cure tendrils from trails	0.88	2.59	0.98	1.57	0.9	1.48	0.93	1.35	0.89	2.03	0.96	1.46
fertilization	0.87	2.56	1.93	3.09	0.93	1.53	2.22	3.22	0.9	2.04	2.08	3.15
Plowing cultivation	8.28	24.37	8.76	14.01	11.52	18.9	9.22	13.36	9.9	21.64	8.99	13.68
spraying	6.75	19.87	8.19	13.1	7.43	12.19	9.34	13.53	7.09	16.03	8.77	13.31
herbicides	2.13	6.27	6.44	10.3	3.18	5.22	5.22	7.56	2.66	5.74	5.83	8.93
dusting	0.38	1.12	0.71	1.14	0.43	0.71	0.71	1.03	0.41	0.91	0.71	1.08
Transportation	12.5	36.8	33.3	53.25	34.5	56.61	39.4	57.08	23.5	46.71	36.35	55.17
Total	33.97	100	62.54	100	60.94	100	69.02	100	47.46	100	65.78	100

**Table 3**  
**Results of the examination expenditure of machine and human work hours per hectare area variety Cardinal**

Work processes	2009				2010				Average			
	Machine hours, h	Percent, %	Human working hours, h	Percent, %	Machine hours, h	Percent, %	Human working hours, h	Percent, %	Machine hours, h	Percent, %	Human working hours, h	Percent, %
Relocation of tendrils from row	1.98	5.02	2.27	4.03	2.13	5.32	2.13	5.32	2.06	5.17	2.2	4.67
Cure tendrils from trails	0.9	2.28	0.96	1.7	1.2	3	1.2	3	1.05	2.64	1.08	2.35
fertilization	0.83	2.1	1.94	3.44	0.83	2.07	0.83	2.07	0.83	2.09	1.39	2.76
Plowing cultivation	8.82	22.35	8.83	15.66	9.14	22.83	9.14	22.83	8.98	22.59	8.99	19.25
spraying	6.43	16.29	7.68	13.62	6.43	16.06	6.43	16.06	6.43	16.18	7.06	14.84
herbicides	2	5.07	6.4	11.35	2.1	5.25	2.1	5.25	2.05	5.16	4.25	8.3
dusting	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	18.5	46.88	28.3	50.2	18.2	45.47	18.2	45.47	18.35	46.17	23.25	47.83
Total	39.46	100	56.38	100	40.03	100	40.03	100	39.75	100	48.21	100

**Table 4**  
**Results of the examination expenditure working hours of manual work processes and yield per hectare of different varieties**

Work processes	2009		2010		Average	
	h	t/ha	h	t/ha	h	t/ha
Wine grapes variety	438	12	518	14.5	478	13.25
Cardinal	725	15	554	8	639.5	11.5
Afus ali	749	17.1	685	10.3	717	13.7

and 3, it is generally noticeable that the regular business processes, regardless of breed or whatever the harvest period did not notice any major deviations. These are the real values obtained in practical terms that portraying the involvement of agricultural machinery and engagement of the people who perform service properly executing workflows.

According to Davcev (1998), variations results in work processes noted to occur before the configuration of the terrain, but also from variety feature, as in workflows taking tendrils from row and trails are not the same tendrils of all sorts, so I noticed slower movement with wine varieties, and especially the variety Cardinal bigger delay tractor his back, because healing was performed with adapted seventh ordinal plow. By recording in the field showed that the machine has high productivity and as a result of the slow movement and frequent stoppages expenditure working hours has increased relative to other varieties.

Tables themselves the greatest deviations transport occurs in the work process, which largely depends on the yield per hectare surface current vegetation year. The results of the yield are shown in Table 4, after years in which the yield is expressed tons per hectare, however, and spent hours in manual work processes, there is a certain proportionality, if we analyze the results of Tables 1, 2 and 3, the results of Table 4, we can see that the biggest difference in expenditure of machine and human work hours occurs precisely in Transportation, Business Process by which occupies an important place where in wine varieties averaged 32.95 hours to service the machine, or the percentage of 51.63%, compared with Table 4, the yield average of 13,25 t/ha, hired labor hours by 478 per hectare in manual work processes. In variety Cardinal expenditure transport machine working hours for the two studied years is 18.35 hours, or the total hours contributed 46.17%, and service of the machine is a notable amount of 23.25 hours, or the total hours involved with 47.83%. Average per hectare spent hours of manual work is 639.50 hours per hectare at an average yield of 11.5 t/ha.

Similar results we have obtained in variety Afus Ali as a table variety, from two years of trials on average spent 23.50 machine hours has 46.71%, human-hour show also large values of 36.35 as a service machine or 55.17%. Variety Afusali variety that features a bit vintage and therefore the resulting average yield of 13.70 t/ha, spent an average of 55.17 hours of manual work. This is due to the fact that in table grapes- varieties Afus Ali and Cardinal noticed phase packing grape harvest which hired transport trailer breaking collection of empty crates and full boxes.

Besides packing table grapes followed the general grape harvest as the final stage which was not intended for the market, but harvesting was designed for processing. In such a case were re engage transport trailers with expenditure of human labor hours, as well as manual work hours.

This review expenditure of manual and machine hours us gives us a clear view, and shows that in the normal working processes arise Uniformity spent hours after work hours, and the total number of machine and human work hours more 50% goes to transportation. This is an agreement with the results obtained by other authors (Davcev, 2007; 1998). Sure analyzing these results we get a clear picture what is the expenditure of direct and indirect energy, but calculative calculations of engagement gear and terminal machinery per hectare area as well as human labor and manual work hours.

With this overview can predict projected costs, but also provides an opportunity to perform a streamlined and cost-effectiveness of their execution, because of the tables themselves can be seen that regardless of the yield they are regular work processes, and require planned costs later Us affect us and participate in the cost per hectare of land, or per kilogram production grapes from a specific variety.

## Conclusion, Proposals and Recommendations

Because the results portraying a production year engagement of certain agricultural machinery, and determined organization of work, it does not mean that other farms dealing with viticulture will be set the same organizational chart. With changing agricultural power and attaching machines leads to a new position in the organization, but also in the expenditure of machine and working human hours, and the resulting quality timely execution of work processes. The analysis shows that the production conditions need to constantly monitor the tendency of purchasing and hiring highly productive machines, and procurement and engaging integral technique, which will be the tendency of reduction of mechanical and human hours in grapes production would be more economical, will receive higher yield as a result of timely and quality execution of work processes.

Now the question is, as manual labor replaced by half mechanized or fully mechanized conditions of our tests, we noted that a large expenditure of manual work hours that are spent hectare area with all sorts, we are not doing economic analysis, but it is difficult to make such an analysis, because the hours spent per hectare after

work processes have been obtained, but the dilemma is whether and when they half mechanized or mechanized as required purchase of new machinery, which requires large assets, and on the other by manual working hour still has minimum values (price), which gives occasion for further analysis, because in our conditions overall machinery is imported and one thing is for it to be purchased, and it is quite another matter for its expensive maintenance. The issue will continue to be popular at the moment when the hand work will be more expensive, but there will be a shortage at that time we will be forced to look for quick solutions to their mechanization, and the launching of new plantations will be conditioned half mechanized or mechanized execution certain work processes.

## References

- Canev, I.**, 2007. New trends of development of agricultural mechanization in grapes production, *Agro-consulting Kocev*, Skopje, pp.1-26 (Mk).
- Davcev, Z.**, 2007. Exploitations of agriculture techniques, *FZNH*, Skopje, 480 pp. (Mk).
- Davcev, Z.**, 1998. Machinery and equipment in grape and fruit production, *Feniks*, Skopje, 274 pp. (Mk).
- Oplanic, M., B. Arbanas, M. Bubola and S. Radinovic**, 2011. The economic success of viticulture and winemaking production - a case study in the Straight districts. In: 46<sup>th</sup> Croatian & 6<sup>th</sup> International Symposium on Agriculture, pp. 211-215 (Hr).
- Manojlović, R., D. Mitrović and S. Savić**, 2009. Technical-technological, exploitational and techno economical work indicators for crape combine harvesters, *Agriculture Technique*, **36** (3): 79-85 (Sr).

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