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EFFECT OF DIFFERENT BUNCH COVERING MATERIALS ON SHAMRAN DATE FOR ENHANCEMENT OF ECONOMICAL YIELD

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ABSTRACT

The experiment was carried out on date palm (*Phoenix dactylifera* L.) cv. "Shamran" at Horticultural Research Station, Bahawalpur (Pakistan) during 2009-11 with the objectives to observe the effect of different bunch covering materials to reduce the rainfall effect for enhancement of economical yield. The experiment was laidout in Randomized Complete Block Design with 5 replications (5 palms). A set of treatments consisting of 5 treatments such as bunches without covering treated as control treatment (T1), bunches covered with polythene bags (T2), glazed paper bags (T3), art paper bags (T4) and polypropylene bags (T5), was applied to tagged bunches on a single palm before the onset of monsoon rains in the month of June (leaving downside of the bags open). Other cultural practices i.e., irrigation, fertilizer applcation and pollination were applied uniformly to all experimental units. The parameters under study were Ferment fruit (%), Fruit drop (%), Benefit ratio (%) over control, Bunch weight (kg) and Cost benefit ratio. Three years data results average indicated that bunches which were covered with polythene bags resulted in minimum fermented fruit (13.4%), minimum fruit drop (11.3%), maximum benefit ratio (56.7%) over control, the heaviest bunch weight (6.7kg), the highest cost benefit ratio (1:34) with maximum profit (67%) over uncovered bunches, followed by those bunches which were covered with polypropylene bags in these parameters. However, bunches covered with either glazed paper bags or art paper bags, both remained statistically similar in effect on the parameters.

Keywords: Bunch cover; date palm; *Phoenix dactylifera* L.; productivity; rainfall.

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is the major fruit crop of Pakistan that is now ranked 7th for production in the world (FAOSTAT, 2010). The total area is 90.1 thousand hectares with annual production of 522.2 thousand tons (Anonymous, 2012). Pakistan trailed in rank from 5th with production 622 thousand tons (FAOSTAT, 2004) to 7th with production 522 thousand tons (FAOSTAT, 2010). The major reason of 100 thousand tons reduction in production during last six years is mainly attributed to monsoon rainfalls occurring at the time of fruit maturation.

Wet weather due to high humidity or rainfall may cause damage to date fruit on the fruit ripening stage. In various date growing areas rain could coincide with the ripening season and consequently causes severe loss of fruit. Rainfall during and right after pollination may reduce the fruit setting (Zaid and de Wet, 2002), but is not generally a great concern. More hazardous are the (early) rains during final maturation of the crop, a realistic possibility in many date growing areas. They are humidity of the air, rainfall and wind which affect date production qualitatively and quantitatively. Apart from direct physical damage, the secondary effects of increased humidity and lower temperature work against the final maturation of date fruit, and favour insect infestation and fungal growth. It is for this reason that in several areas preventive measures are taken by protecting the date fruit bunches with covers (Karampour and Davoodian, 2010; Zirari and Laaziza Ichir, 2010).

Date palm bunch covers offer several advantages to protect fruits from high humidity and rain, from bird attacks and also from damage caused by insects and diseases. A sturdy light-brown craft-paper is used in the USA to cover and provide good protection of the bunch during the ripening season (Zaid and de Wet, 2002). Date bunches are covered with paper bags against early rains and sunburn in California. Bunch covering is, however, not only practiced against rain damage but traditionally is also used in the form of coarsely woven well-ventilated baskets (sund) to protect the maturing fruit from birds and prevent early ripening fruit from falling to the ground. Material choice of the cover and ventilation, therefore, become of prime importance when selecting a method of bunch protection (FAO Agricultural Services Bulletin, 1993). Damage to date fruit 6.79% in mat-like basket, 10.62% in Aluminum foil, 16.92% in wax and 19.16% in control (without cover) was reported in a study on effect of different bunch covers against date bunch fading disorder (Pezhman *et al*., 2005). Bunches covered from Khalal stage to the time the weather conditions became suitable with mat baskets, plastic bags, hemp bags and cloth net bags. Mat baskets showed to be more effective against bunch fading disorder than the other materials (Shirazi *et al*., 2008). Cover bags including jute cover, and net covers with

meshes as small as 3.8, 1.7 and 0.15 mm^2 to avoid infestation by moths (*Ectomyelois ceratoniae*) in date fruit resulted in the lowest infestation rates (less than 1%) with net covers of 1.7 and 0.15 mm^2 meshes while the highest damages (4.1 and 4.5%) occurred with jute covers and control respectively (Zirari and Laaziza Ichir, 2010). Damage to fruit occurred in plastic cover 23.88%, mat cover 31.11%, cloth cover 34.57% and hemp cover 49.31% and in control treatment (without cover) 58.31% against date palm bunch fading disorder (Karampour and Davoodian, 2010).

Monsoon rainfall causes major fruit losses in date palm at the time of fruit maturity. The current study was carried out to minimize fruit damage due to monsoon rainfall in Shamran date cultivar by covering the bunches with bags made of different material seeking the best suited bunch cover as well as considering the economics of date palm growers.

MATERIALS AND METHODS

The experiment was conducted during three consecutive years i.e., 2009, 2010 and 2011 on "Shamran" date variety in orchard of Horticultural Research Station, Bahawalpur (Pakistan). The plants were of 20-year-old, uniform in size, growth and vigour which were provided with normal schedule of cultural practices i.e., irrigation, fertilizer application and pollination etc. Five bunches almost similar in age and vigour i.e., having same spathe opening and maturity time as well as similar number of strands, were selected on each palm every year. All palms were pollinated with same pollen source (a vigorous male date palm growing in the same orchard) by manual dusting of pollens with the help of bamboo (one end of which was wrapped by muslin cloth to stick the pollens) during mid of March each year. At the time of fruit maturity during the month of June before the onset of monsoon rains, bunches were covered with the bags made of different material (Fig. 1). A set of treatments consisting of 5 treatments viz bunches without covering treated as control treatment (T1), bunches covered with polythene bags (T2), bunches covered with glazed paper bags (T3), bunches covered with art paper bags (T4) and bunches covered with polypropylene bags (T5), was applied to tagged bunches on a single palm. The bags were tied from upper side covering the whole bunch leaving downside of the bags open (Fig. 1). Each set of treatments (5 treatments) was applied to a single palm, replicating the experiment with 5 replications (5 date palm tree) in accordance with Randomized Complete Block Design (RCBD). The data were statistically analyzed using Analysis of Variance technique, followed by comparison of treatment means by LSD test at 5% significance (Steel *et al*., 1997).

Assessment of Parameters

Fermented fruit percentage: Fermented fruits were selected by visual observation. Ferment fruit (%) from a treated bunch was estimated through the given formula and averaged over replications.

$$\text{Ferment fruit (\%)} = \frac{\text{Number of fermented fruit per bunch}}{\text{Number of total fruit per bunch}} \times 100$$

Fruit drop percentage: Fruit drop (%) from a treated bunch was calculated by the given formula and averaged over replications.

$$\text{Fruit drop (\%)} = \frac{\text{Number of dropped fruit per bunch}}{\text{Number of total fruit per bunch}} \times 100$$

Benefit ratio (%) over control: To calculate this parameter; first fruit loss percentage (ferment fruit % + dropped fruit %) was calculated in control (without covering), then in a specific treatment (bunch covered with a material). Benefit ratio (%) over control was measured by applying following formula:

Benefit ratio (%) over control = 100-{fruit loss (%) in control / fruit loss (%) in a specific treatment}

Bunch weight (kg): Bunches of the palms under investigation were harvested at full maturity stage at the end of August, weighed by digital electronic balance and averaged over replications.

Cost benefit ratio: To calculate cost benefit ratio; first bunch value (Rs.) denoted by **B** was determined by multiplying individual bunch weight with prevailing market price per kilogram (Rs.=50), then bunch value was divided by the price per bag (Rs.) denoted by **A** in Table 2.

Profit (%) over control: It was estimated by putting the respective values in the following formula:

Profit (%) over control = [{(B-A) - 195}/195] * 100

In this formula 195 is average bunch value of control (uncovered bunch) treatment.

RESULTS

Fermented fruit (%), fruit drop (%) & benefit ratio (%) over control: Fermented fruit percentage, fruit drop percentage and benefit ratio (%) over control were significantly affected by bunch covering with different materials (Table 1). On three years average basis; minimum fermented fruit (13.4%), fruit drop (13.9%) with maximum benefit ratio (56.7%) over control were recorded by those bunches which were covered with polythene bags, followed by those bunches which were covered with polypropylene bags giving fermented fruit (15.0 %), fruit drop (15.7 %) with benefit ratio (49.5%)

over control. The bunches covered with either glazed paper bags or art paper bags were statistically similar in effect for the parameters under study as both showed about 21 % fermented fruit, 17 % fruit drop and 38 % benefit ratio over control (Table 1).

Bunch weight: On three years average basis; individual bunch weight was significantly affected by covering the bunch with different materials (Table 2). Maximum bunch weight (6.7 kg) was obtained by those bunches which were covered with polythene bags, followed by bunches covered with polypropylene bags. However, both types of bunch covers were statistically at par with respect to bunch weight. Bunches covered with glazed paper bags or art papers bags were statistically similar by gaining 5.5-5.7 kg bunch weight. Bunches under control (uncovered) attained significantly the minimum weight (3.9 kg).

Cost benefit ratio & profit (%) over control: Bunches covered with polythene bags expressed significantly the highest cost benefit ratio (1:34) fetching the maximum profit (67%) over control. Bunches covered with polypropylene bags, though remained statistically at par in bunch weight with bunches covered with polythene bags, yet it had less cost benefit ratio (1:16) with about 50% profit over control. However, bunches covered with either glazed paper bags or art paper bags, both had same cost benefit ratio (1:14) giving 31-36 % profit over control (Table 2).

Correlation among different economic parameters: Coefficients of correlation among different economic parameters were studied under different covering material and rainfall intensities and presented in Table 3. Negative linear correlation was found between ferment fruit % and bunch weight as well as between fruit drop% and bunch weight under covering bags or uncovered bunches at three intensities of rainfall representing three years of the experiment. However, positive linear correlation was observed between ferment fruit % and fruit drop% under all treatments for three intensities of rainfall. Strong positive correlation was found between bunch weight and benefit percentage under polythene bags cover as well as under polypropylene bags cover for all intensities of rainfall. However, negative correlation was found between bunch weight and benefit percentage under glazed paper bags cover as well as under art paper bags cover for the same intensities of rainfall.

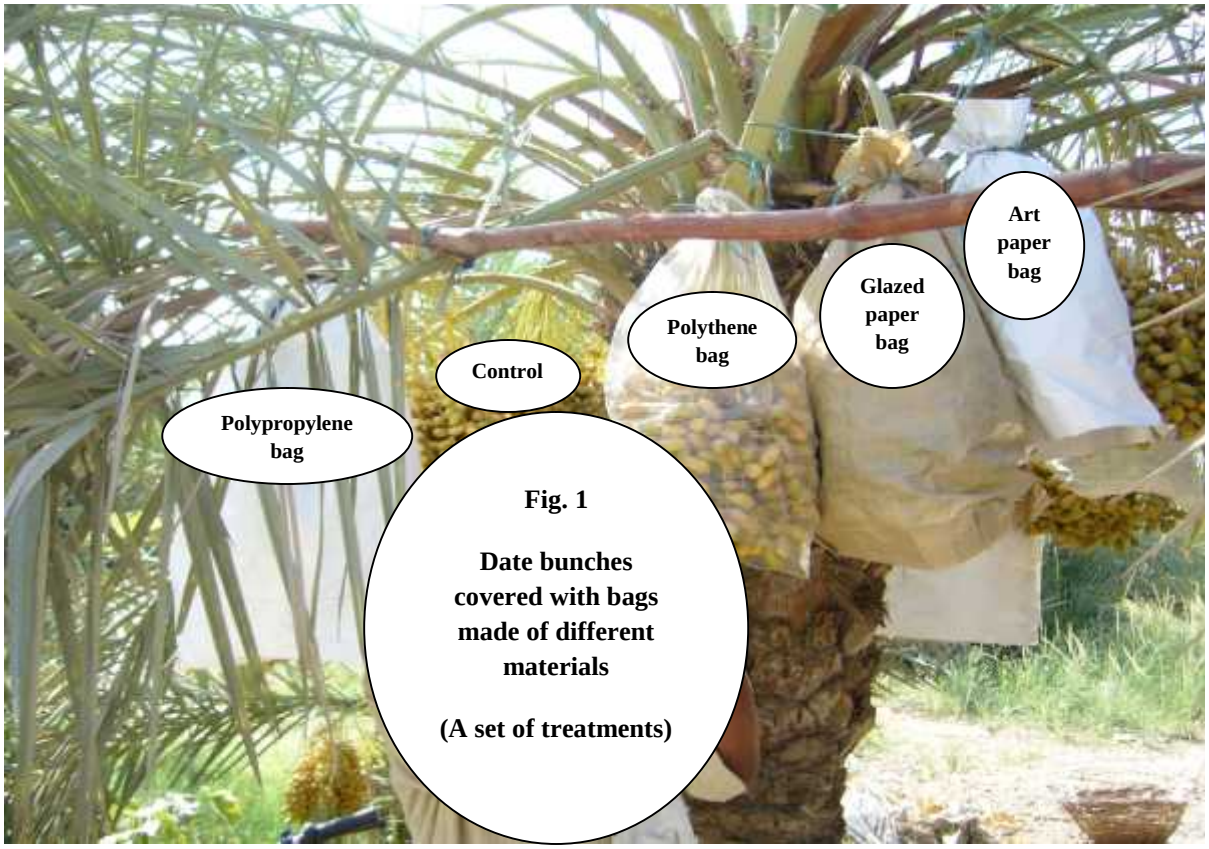

Fig. 1

Date bunches covered with bags made of different materials

(A set of treatments)

Table 1. Fermented fruit, fruit drop and benefit ratio percentages as affected by bunch covering with different materials to minimize rainfall effect on fruit of date cv. Shamran at Bahawalpur during 2009-2011.

Treatments	Ferment fruit (%)				Fruit drop (%)				Benefit ratio (%) over control			
	2009	2010	2011	Average	2009	2010	2011	Average	2009	2010	2011	Average
T1=Control	36.6^{a}	50.3^{a}	25.3^{a}	37.4^{a}	21.1^{a}	30.4^{a}	18.4^{a}	23.3^{a}	-	-	-	-
T2=polythene bags	4.4^{d}	26.9^{d}	8.8^{c}	13.4^{c}	8.5^{d}	22.0^{c}	11.3^{c}	13.9^{c}	77.6^{a}	39.4^{a}	53.2^{a}	56.7^{a}
T3= glazed paper bags	14.5^{b}	30.9^{bc}	16.3^{b}	20.6^{b}	11.1^{b}	27.0^{ab}	13.9^{bc}	17.3^{b}	55.5^{d}	27.7^{b}	30.2^{c}	37.8^{c}
T4= art paper bags	10.8^{c}	32.4^{b}	18.2^{b}	20.5^{b}	10.6^{bc}	25.4^{bc}	15.5^{b}	17.1^{b}	62.6^{c}	28.0^{b}	22.6^{c}	37.7^{c}
T5= polypropylene bags	7.1^{d}	28.0^{cd}	10.0^{c}	15.0^{c}	9.1^{cd}	25.3^{bc}	12.7^{c}	15.7^{b}	71.8^{b}	33.8^{ab}	42.8^{b}	49.5^{b}
LSD (5%)	3.1	3.9	4.5	4.7	1.7	4.4	2.7	1.6	4.0	8.7	9.7	7.0
Rainfall (mm)	72	223	43	113	72	223	43	113	72	223	43	113

Values sharing similar letter (s) in a column do not differ significantly at α=0.05

Table 2. Bunch weight, cost benefit ratio and profit (%) over control as affected by bunch covering with different materials to minimize rainfall effect on yield of date cv. Shamran at Bahawalpur during 2009-2011.

Treatments	Bunch weight (kg)				Price per bag (Rs.)	Bunch value (Rs.)	Cost benefit ratio	Profit (%) over control
	2009	2010	2011	Average	(A)	(B)	B/A	[{(B-A) - 195}/195]*100
T1=Control	4.0^{b}	1.7^{c}	6.1^{c}	3.9^{c}	-	195	-	-
T2=polythene bags	7.3^{a}	4.5^{a}	8.2^{a}	6.7^{a}	10	335	1:34^{a}	67%^{a}
T3= glazed paper bags	6.3^{b}	3.7^{b}	7.0^{b}	5.7^{b}	20	285	1:14^{b}	36%^{c}
T4= art paper bags	6.5^{a}	3.5^{b}	6.4^{bc}	5.5^{b}	20	275	1:14^{b}	31%^{c}
T5= polypropylene bags	6.9^{a}	3.8^{b}	8.1^{a}	6.3^{a}	20	315	1:16^{b}	51%^{b}
LSD (5%)	0.9	0.5	0.7	0.4	-	-	1:17	14%
Rainfall (mm)	72	223	43	113	-	-	-	-

Values sharing similar letter (s) in a column do not differ significantly at α=0.05

Table 3. Coefficients of correlation for different economic parameters studied under different covering material and rainfall intensity

Economic parameters	Rainfall (mm)	Control (no cover)	Polythene	glazed paper	art paper	polypropylene
Ferment fruit % – Bunch weight	72	-0.078	-0.562	-0.568	-0.613	-0.686
	223	-0.713	-0.046	-0.171	-0.845	-0.322
	43	-0.957	-0.064	-0.078	-0.464	-0.120
Fruit drop% – Bunch weight	72	-0.261	-0.895	-0.583	-0.250	-0.607
	223	-0.942	-0.750	-0.162	-0.156	-0.301
	43	-0.900	-0.334	-0.053	-0.228	-0.393
Ferment fruit % – Fruit drop%	72	+0.258	+0.491	+0.364	+0.136	+0.973
	223	+0.460	+0.174	+0.035	+0.482	+0.515
	43	+0.951	+0.927	+0.056	+0.896	+0.876
Bunch weight – Benefit %	72	-	+0.942	-0.319	-0.177	+0.949
	223	-	+0.764	-0.242	-0.713	+0.258
	43	-	+0.412	-0.728	-0.463	+0.272

DISCUSSION

Reduction in bunch weight seems to be dependent on intensity of rainfall during monsoon. Medium intensity rainfall (72 mm) during monsoon (2009) caused fermented fruit (36.6%) and fruit drop (21.1%) in control (uncovered bunches), which reduced bunch weight to 4.0 kg per bunch. High intensity rainfall (223 mm) during July-August, 2010 caused maximum fruit loss in terms of fermented fruit (50.34%) and fruit drop (30.38%) in control, hence bunch weight reduced to the lowest (1.69 kg per bunch). Low intensity rainfall (43 mm) during monsoon (2011) caused fermented fruit (25.29%) and fruit drop (18.40%) in control which reduced bunch weight to 6.06 kg per bunch (Table 2). The results of this experiment showed that increase in air humidity due to rainfall has important role in date fruit losses and economics of date fruit growers. Using suitable bunch cover such as polythene bags preferably or polypropylene bags protect against harmful effect of rainfall by increasing transpiration rate from bunches due to increased temperature in both kinds of bags. They also have other advantages like cheapness, easy availability and durability compared to bags made of other material. Hence, material choice of the cover and covering technique can play prime role while protecting date palm bunches against various biotic and abiotic factors(Zaid and de Wet, 2002; Shirazi*et al*., 2008; Karampour and Davoodian, 2010; Zirari and Laaziza Ichir, 2010).

Conclusion: Rainfall at fruit maturity of date palm is a serious hazard. Covering of date fruit bunches with polythene bags proved successful to minimize damage due to rainfall and resulted in 56.7 % benefit over control (without covering) with minimum fermented fruit (13 .4%), minimum fruit drop (13.9%) and maximum bunch weight (6.7 kg) with high cost benefit ratio (1:34) and maximum profit (67%) over control.

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