
Evaluation of coconut germplasm for fruit component traits and oil yield

V. Niral, R.V. Nair, B. Augustine Jerard, K. Samsudeen, M.J. Ratnambal

Central Plantation Crops Research Institute, Kasaragod-671 124, Kerala

Abstract

Work on evaluation of coconut germplasm and hybrids to identify superior lines are in progress at the Central Plantation Crops Research Institute. The present study was undertaken to determine the variability for fruit component traits in the conserved coconut germplasm available at the Central Plantation Crops Research Institute and to determine the association between these traits. A total of 71 coconut accessions, including 58 tall accessions and 13 dwarf accessions were studied for 12 fruit component traits [weight of fruit (g), thickness of husk (cm), weight of nut (g), husk wt. (g/nut), percentage of husk, thickness of kernel (cm), weight of kernel (g/nut), thickness of shell (cm), weight of shell (g/nut), copra content (g/nut), oil percentage, oil content (g/nut)] and two related parameters viz., oil and copra yield/ha. The fruit component analysis indicated wide variability among the coconut accessions for most of the traits studied. The highest CV values were observed for copra yield/ha, oil yield/hectare and weight of nut, respectively. Only oil content in the copra showed a very low C.V of 3.18%, indicating lesser variability for this trait among the accessions studied and also suggesting that oil yield/ha is more influenced by endosperm/copra yield and not by oil percentage *per se*. Another trait with comparatively lesser CV value was thickness of kernel again indicating that variation in copra/endosperm weight is less influenced by the thickness of the endosperm and is rather determined by the size of the nut. The copra content per nut ranged from 349g in the case of SNRT to 70.40g in the case of SUBD. In general, low copra and oil content was recorded in the dwarf accessions. On the other hand, the large-fruited accessions SNRT, MLT and MVT yielded more than 200ml of oil/nut. The copra and oil yield/ha among the accessions ranged from 0.6-4.46t/ha and 0.4-2.94 t/ha, respectively. The most inferior accessions were SUBD and the New Caledonian accession NUFT, while the most superior accessions producing more than 4t copra/ha and more than 2.6t oil/ha were FJLT, ADRT, JVT, PHOT and AGT, respectively. The correlation coefficients for the fruit component traits indicated highly significant positive correlation of fruit weight with weight of all the component traits, viz., husk, shell, kernel, copra and oil content per fruit. The thickness of the husk did not show any significant correlation with any of the fruit component traits. On the other hand, the percentage of husk showed significant negative correlation with nut weight kernel weight and copra weight, indicating the need to select accessions with lesser husk percentage while breeding for higher endosperm/oil yield. Copra yield/ha and oil yield/ha showed highly significant positive correlation among themselves, indicating that these are not influenced by the fruit component traits alone and the influence of annual nut yield on these two traits. Therefore, the fruit weight, husk percentage and nut yield appear to be the most important characters influencing coconut oil output per hectare and hence it is possible to improve coconut oil productivity in the coconut plantations by selection of superior accessions based on these traits.

Keywords: Coconut, *Cocos nucifera* L., germplasm, fruit component traits, oil yield

Introduction

Coconut, *Cocos nucifera* L., is an important oil yielding palm cultivated in the humid coastal tropics. In India, coconut oil accounts for about 7-8% of the total edible oil production in the country. Coconut oil extracted from copra, the dried kernel (endosperm) of coconut, is used in various industrial applications, in soap, hair oil and cosmetics. Coconut oil is rich in lauric acid, which is known for being antiviral, antibacterial and antifungal, contains no trans fat and boosts the immune system. It is also important cooking oil in southern parts of India, especially in the state of Kerala. Coconut oil has also been tested for use as a diesel engine fuel and as an engine lubricant. Annually about 5.5 million tonnes of coconut oil is produced with Indonesia, Philippines and India being the top three leading producers. India is at present the largest producer of coconut in the world with an annual production of 1584 million nuts (2006-07). The annual production of copra in the country is estimated to be 7.5 lakh tonnes with coconut oil production of 4.4 lakh tonnes. In addition, India imports around 2000-7000

tons of crude coconut oil. To enable self sufficiency in edible oil production, the Government of India is encouraging planting of coconut and oil palm plantations in the country. To improve the productivity in the coconut sector, improved and high yielding varieties have been released. At the Central Plantation Crops Research Institute work on evaluation of coconut germplasm and hybrids is in progress to identify superior lines. Presently, the coconut germplasm repository at CPCRI, has 132 exotic and 233 indigenous types. Various workers have studied and reported wide variability for fruit component traits in coconut populations (Ashburner *et al.*, 1997; Sugimura *et al.*, 1997). Harries (1978) hypothesized that variation in fruit morphology in coconut is the result of domestication by human selection. The present study was undertaken to determine the variability for fruit component traits in the conserved coconut germplasm available at the Central Plantation Crops Research Institute and to determine the association between these traits.

Materials and methods

The study was conducted at the Central Plantation Crops Institute using the conserved coconut germplasm maintained in the national field gene bank. A total of 71 coconut accessions, including 58 tall accessions and 13 dwarf accessions were studied for 12 fruit component traits [weight of fruit (g), thickness of husk (cm), weight of nut (g), husk wt. (g/nut), percentage of husk, thickness of kernel (cm), weight of kernel (g/nut), thickness of shell (cm), weight of shell (g/nut), copra content (g/nut), oil percentage, oil content (g/nut)] and two related parameters *viz.*, oil and copra yield per hectare. The mean values were subjected to statistical analysis. The mean, standard error and coefficient of variation were calculated. To estimate the association among the different characters observed, simple correlation coefficients were worked out.

Results and discussion

The fruit component analysis indicated wide variability among the coconut accessions for most of the traits studied. The highest CV values were observed for copra yield/ha, oil yield/hectare and weight of nut, respectively. Only oil content in the copra showed a very low CV of 3.23%, indicating lesser variability for this trait among the accessions studied and also suggesting that oil yield/ha is more influenced by endosperm/copra yield and not by oil percentage *per se*. Another trait with comparatively lesser CV value was thickness of kernel again indicating that variation in copra/endosperm weight is less influenced by the thickness of the endosperm and is rather determined by the size of the nut. The copra content per nut ranged from 349 g in the case of SNRT to 70.40g in the case of SUBD. The accessions, MLT and MVT also gave more than 300g copra per nut. On the other hand, low copra content of less than 100g per fruit was recorded in the dwarf accessions SUBD, CGD and CGD01 and the tall accessions LMT and NIFT. Ratnambal *et al.* (2005) reported an even wider range of variation from 70-411g for this character. Among the dwarf accessions, CRD recorded the highest copra content per nut (219.80g), which was much comparable to that recorded by the superior tall accessions indicating that though dwarfs in general produce small to medium sized fruits with lesser copra content, there are exceptions and it is a possible to select dwarf accessions showing superiority for copra content/nut. Low oil yield/nut of less than 50ml was recorded in the dwarfs SUBD, CGD and CGD01, while LMT and AYKT among tall produced less than 70ml of oil/nut. Among the dwarf accessions, CRD recorded the highest oil yield per nut (140.67ml), which was superior to that obtained from the majority of the tall accessions. On the other hand, the large-fruited accessions SNRT, MLT and MVT yielded more than 200ml of oil/nut.

The copra and oil yield/ha among the accessions ranged from 0.6-4.46t/ha and 0.4-2.94 t/ha, respectively. The most inferior accessions were SUBD and the New Caledonian accession NUFT, while the most superior accessions producing more than 4t copra/ha and more than 2.6t oil/ha were FJLT, ADRT, JVT, PHOT and AGT, respectively. Among the dwarf accessions studied, only CRD produced more than 3t of copra/ha and more than 2t of oil/ha, further highlighting the superiority of this dwarf accession. The correlation coefficients for the fruit component traits (Table 1) indicated highly significant positive correlation of fruit weight with weight of all the component traits, *viz.* husk, shell, kernel, copra and oil content per fruit. Ratnambal *et al.* (2005) reported high correlation (>0.9) between nut weight with fruit weight, endosperm weight and cavity volume. The thickness of the husk did not show any significant correlation with any of the fruit component traits. On the other hand, the percentage of husk showed significant negative correlation with nut weight kernel weight and copra weight, indicating the need to select accessions with lesser husk percentage while breeding for higher endosperm/oil yield. Copra yield/ha and oil yield/ha showed highly significant positive correlation among themselves, indicating that these are not influenced by the fruit component traits alone and the influence of annual nut yield on these two traits. The thickness of the kernel as well as the thickness of the shell showed no significant correlation with the rest of the fruit component traits. Therefore, the fruit weight, husk percentage and nut yield appear to be the most important characters influencing coconut oil output/ha. Hence, it is possible to improve coconut oil productivity in the coconut plantations by selection of superior accessions based on these traits. Coconut oil being rich in lauric acid has enormous potential in tapping the growing multi-billion dollar food and pharmaceutical business where lauric oils and their derivatives have many applications. Therefore, there is a need to improve the productivity and oil yield of coconut plantations to make them competitive in the global economy.

Table 1 Correlation coefficient among fruit component traits and oil yield in coconut

Traits	Weight of fruit	Thickness of husk	Weight of nut	Wt. of husk	Percentage of husk	Thickness of kernel	Weight of kernel	Thickness of shell	Weight of shell	Copra content	Oil (%)	Oil content	Copra/ha	Oil/ha
Weight of fruit	1.000	0.39	0.948**	0.812**	-0.281	0.354	0.899**	0.261	0.905**	0.891**	0.078	0.891**	0.415	0.413
Thickness of husk		1.000	0.283	0.475	0.185	0.239	0.262	0.182	0.318	0.302	0.093	0.315	0.042	0.047
Weight of nut			1.000	0.585*	-0.544*	0.246	0.96	0.271	0.875**	0.926**	0.033	0.922**	0.451	0.449
Weight of husk (g)				1.000	0.284	0.453	0.533*	0.168	0.705*	0.575*	0.137	0.582*	0.23	0.233
Percentage of husk					1.000	0.09	-0.574*	-0.195	-0.357	-0.515*	0.155	-0.497	-0.307	-0.296
Thickness of kernel						1.000	0.176	-0.035	0.413	0.294	0.026	0.286	0.187	0.185
Weight of kernel							1.000	0.257	0.808**	0.914**	0.057	0.913**	0.41	0.411
Thickness of shell								1.000	0.303	0.221	0.228	0.24	0.014	0.027
Weight of shell									1.000	0.886**	-0.027	0.877**	0.33	0.318
Copra content										1.000	0.023	0.995**	0.464	0.462
Oil Percentage											1.000	0.121	0.049	0.127
Oil content												1.000	0.455	0.458
Copra/ha													1.000	0.996**
Oil/ha														1.000

References

Ashburner, G.R., Thompson, W.K., Halloran, G.M. and Foale, M.A. 1997. Fruit component analysis of South Pacific coconut palm populations. *Gen. Res. Crop Evol.*, **44**: 327-335.

Harries, H.C. 1978. The evolution, dissemination and classification of *Cocos nucifera* L. *The Botanical Review*, **44**: 265-319.

Ratnambal, M.J., Muralidharan, K., Krishnan, M. and Amarnath, C.H. 2005. Diversity of coconut accessions for fruit components. *Journal of Plantation Crops*, **33**(1): 1-8.

Sugimura, Y., Itano, M., Salud, C.D., Otsuji, K. and Yamaguchi, H. 1997. Biometric analysis on diversity of coconut palm: cultivar classification by botanical and agronomical traits. *Euphytica*, **98**: 29-35.

Studies on sowing time in relation to newly released linseed varieties for double cropping system

O.P. Mathuria, R.A. Yadav, D. Singh and R.S. Baghel

AICRP on Linseed, C.S. Azad University of Agriculture and Technology, Kanpur-208 002, UP

Abstract

An experiment was conducted under irrigated condition on sandy loam soil during the winter seasons of 2004-05 and 2005-06 to study the effect of optimum sowing time for linseed (*Linum usitatissimum* L.) among 3 dates of sowing during third week of November was found optimum. Among the four varieties viz., Garima, Subhra, Sekhar and T-397. Yield, net marginal return and B:C were higher in third week of sowing. The yield, net marginal return and B:C were optimize in Sekhar.

Keywords: Linseed, sowing time, monetary returns

Introduction

The oil of linseed (*Linum usitatissimum* L.) is a major raw material for surface coating industry, with a sizeable portion being used for edible purposes. But it is chosen for a piece of land where only dryland crops can be grown or placed under different mixed cropping systems to cover risk against the natural hazards. Under such condition there is hardly any crop as remunerative as the linseed. Since very little work on production technology of this crop has been done in Uttar Pradesh, an experiment was conducted to identify promising varieties and optimum time of sowing for this crop under irrigated conditions for double cropping system.

Materials and methods

The field experiment was conducted at Oilseeds Farm, Kalyanpur, Kanpur during the winter (*rabi*) season of 2004-05 and 2005-06 in Split Plot Design, with dates of sowing in main plot and varieties in subplots, replicated thrice. The soil of the experimental plot was sandy loam with alkaline in reaction having pH 8.2, medium available organic carbon 0.52%, available phosphorus 18.6 kg/ha and available potassium 208 kg/ha. The treatment consisted of 3 dates of sowing, viz., third week November (D₁) last week of November (D₂) and second weeks of December and 4 varieties, viz., Garima, Subhra, Sekhar and T-397. A common dose of 80 kg N, 40 kg P₂O₅ and 40 kg K₂O/ha was applied. Besides pre-sowing irrigation, 3 irrigations were provided at critical stages in each treatment. Yield, net marginal return and B:C ratio were recorded.