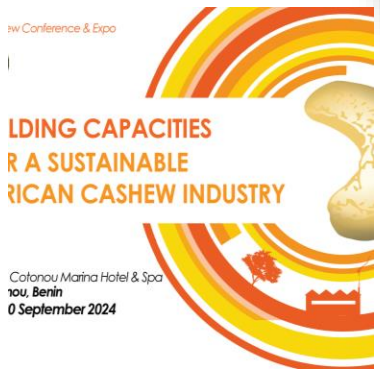


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BUILDING CAPACITIES FOR A SUSTAINABLE AFRICAN CASHEW INDUSTRY

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# On - farm evaluation of cashew *(Anacardium occidentalli L.)* progenies for earliness to flowering and nut yield in the Affram Plains of Ghana.

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# Introduction

- Cashew is an economic crop of high export value to producing countries.

- Cashew is constrained by low nut yield attributed to drought, declining soil fertility levels as well as pests and diseases.

- Flowering is one of the critical processes of production in nut tree crops.

- Cashew flowering and fruiting coincides with the annual drought characterized by severe moisture stress, low humidity, ghastly winds and high temperatures

- Drought-escape is a common adaptable strategy exploited by plants in response to drought stress.

- In this strategy, flowering and fruiting is accelerated to shorten the entire life cycle before severe drought stress hinders productivity.

- The introduction of high yielding food crops with a short growing season is considered to be an effective strategy for narrowing food gap.

❖The objectives of the present study are to:

(1) Identify cashew hybrids that combine high flowering intensity in the early month with high yields.

(2) determine the heritability of flowering intensity and other agronomic traits.

(3) assess the phenotypic correlation among agronomic traits and flower intensity.

# Plant culture & field establishment

- Manual pollinations were carried out to generate nine (9) $F_1$ cashew progenies.

- The first four set (BE 059 × TAN 100, BE 059 × TAN 992, BE 059 × TAN 992, SG 287 × TAN 992) were evaluated against the standard (SG 287 × TAN 100) at Agotime I on farmers field.

- The second four set (BE 059 × TAN 039, BE 107 × TAN 039, SG 266 × TAN 992, SG 287 × TAN 240) were evaluated against the standard (SG 287 × TAN 100) at Agotime II on farmers field.

- The trial was laid out in a randomized complete block design with two replications of 12 plants per cross/plot at a spacing of 10 m × 10 m (100 plants per hectare).

# Data collection

- Canopy spread EW
- Canopy spread NS
- Nut yield (kg/ha)
- Nut weight (g)
- Shelling (%)
- Flower intensity (%) score based on visual ratings

Visual score of 0%

Visual score of 2%

Visual score of 50%

# Results

**Table 1.** Soil characteristics of experimental sites at a depth of 0 - 15cm

# Soil nutrient analysis

| | Location | | |
|---|---|---|---|
| **Soil Parameters** | **Agotime I** | **Agotime II** | **Critical values** |
| **Soil pH** | **7.26** | **6.99** | **5.2-7.5** |
| **Organic C (%)** | **0.80** | **0.60** | **2%** |
| **Total N (%)** | **0.05** | **0.05** | **0.10%** |
| **Avail. P (ppm)** | **22.25** | **16.30** | **>10ppm** |
| **Exch. Mg (cmolc kg-1)** | **0.72** | **0.58** | **0.8 cmolc $kg^{-1}$** |

**Table 2.** Mean square from analysis of variance for canopy spread - EW (m), canopy spread- NS (m), cumulative yield (kg/ha), mean yield (kg/ha), nut weight (g), shelling (%) and flower intensity (%) of five cashew progenies evaluated at Agotime I in the Affram Plains of Ghana.

| Source | *df* | Canopy spread - EW | Canopy spread - NS | Cumulative yield | Mean Yield | Nut weigh t | Shelling | Flower intensity |
|---|---|---|---|---|---|---|---|---|
| Block | 1 | 0.05 | 0.15 | 1364 | 2063.6 | 5.9 | 161.3 | 24.4 |
| Progeny | 4 | 3.1** | 2.67** | 22903*** | 7157.3*** | 2.4 | 82.3 | 210.6*** |
| Residual | 3 | 0.18 | 0.18 | 5093 | 193.4 | 0.4 | 14.2 | 7.6 |
| $\sigma^2 G$ | | 1.46 | 1.25 | 8905 | 3481.9 | 0.9 | 34.0 | 101.5 |
| $\sigma^2 P$ | | 1.64 | 1.43 | 13998 | 3675.4 | 1.4 | 48.2 | 109.1 |
| Heritability | | 0.89 | 0.87 | 0.64 | 0.95 | 0.71 | 0.71 | 0.93 |

**Table 3.** Mean square from analysis of variance for canopy spread - EW (m), canopy spread- NS (m), cumulative yield (kg/ha), mean yield (kg/ha), nut weight (g), shelling (%) and flower intensity (%) of five cashew progenies evaluated at Agotime II in the Affram Plains of Ghana.

| Source | *df* | Canopy spread - EW (m) | Canopy spread - NS (m) | Cumulative yield (kg/ha) | Mean Yield (kg/ha) | Nut weight (g) | Shelling (%) | Flower intensity (%) |
|---|---|---|---|---|---|---|---|---|
| Block | 1 | 0.1 | 0.5 | 43650 | 10041 | 0.83 | 8.6 | 12.8 |
| Progeny | 4 | 3.8* | 3.4* | 9980* | 6057* | 1.2 | 26.1 | 123.2*** |
| Residual | 3 | 1.4 | 1.2 | 7753 | 1681 | 1.6 | 22.3 | 48.8 |
| $\sigma^2$ G | | 1.2 | 1.105 | 1113.5 | 2188 | 0.2 | 1.9 | 37.2 |
| $\sigma^2$ E | | 2.6 | 2.305 | 8866.5 | 3869 | 1.4 | 24.2 | 86.0 |
| Heritability | | 0.47 | 0.48 | 0.13 | 0.57 | 0.14 | 0.10 | 0.43 |

**Table 4.** Mean cashew canopy spread - EW (m), canopy spread - NS (m), cumulative yield (kg/ha), mean yield (kg/ha), nut weight (g), shelling (%) and flower intensity (%) of five cashew progenies evaluated at Agotime I in the Affram Plains of Ghana from 2022/23.

| Genotype | Canopy spread NS | Canopy spread EW | Flowering Intensity | Mean yield | Cumulative yield | Shelling (%) | Nut weight (g) |
|---|---|---|---|---|---|---|---|
| BE 107 X TAN 039 | 4.1a | 4.1a | 8.1a | 30.1a | 60.3a | 27.4a | 8.4a |
| BE 059 X TAN 039 | 4.5a | 4.7a | 19.5b | 73.9b | 148b | 31.6a | 7.3a |
| SG 287 X TAN 100 | 2.4c | 2.5c | 9.0a | 164.4c | 244cb | 23.4a | 7.6a |
| SG 287 X TAN 240 | 5.6b | 6.0b | 29.8b | 134.5c | 269cb | 30.9a | 6.2a |
| SG 266 X TAN 992 | 4.1a | 4.3a | 28.3b | 166c | 332.1c | 32.0a | 7.7a |
| Mean | 4.1 | 4.3 | 18.9 | 113.8 | 210.7 | 29.1 | 7.5 |

Different letters, separately on mean values of canopy spread, yield, cumulative yield, nut weight, flowering intensity and shelling (%) indicate significant difference at $p \leq 0.05$ level based on Duncan's multiple range test.

**Table 5.** Mean cashew canopy spread - EW(m), canopy spread- NS (m), cumulative yield (kg/ha), mean yield (kg/ha), nut weight (g), shelling (%) and flower intensity (%) of five cashew progenies evaluated at Agotime II in the Affram Plains of Ghana from 2022 - 2023.

| Genotype | canopy spread EW | canopy spread NS | Flowering intensity | Mean yield | Cumulative yield | Nut weight | Shelling |
|---|---|---|---|---|---|---|---|
| BE 059 X TAN 100 | 4.4ac | 4.3ac | 11.1a | 53a | 106a | 7.3ab | 25.3ac |
| BE 059 X TAN 992 | 4.0ac | 4.0ac | 17.0c | 145b | 293bc | 8.7b | 26.3ac |
| SG 138 X TAN 100 | 5.1c | 4.9c | 7.7a | 78a | 148ab | 7.3ab | 27.6ac |
| SG 287 X TAN 100 | 1.5b | 1.5b | 2.3b | 190b | 156ab | 8.2ab | 18.5a |
| SG 287 X TAN 992 | 4.2ac | 4.1ac | 22.4c | 95a | 190b | 5.9a | 36.4bc |
| Mean | 3.8 | 3.8 | 12.1 | 112 | 178.6 | 7.6 | 26.8 |

Different letters, separately on mean values of canopy spread, yield, cumulative yield, nut weight, flowering intensity and shelling (%) indicate significant difference at $p \leq 0.05$ level based on Duncan's multiple range test.

**Table 6.** Phenotypic correlation coefficients for cashew canopy spread - EW(m) , canopy spread - NS (m), cumulative yield (kg/ha), mean yield (kg/ha), nut weight (g), shelling (%) and flower intensity (%) of five cashew progenies evaluated at Agotime I & II in the Affram Plains of Ghana from 2022 - 2023.

| Trait | Cumulative yield | Flowering intensity | Mean yield | Nut weight | Shelling | Canopy Spread EW |
|---|---|---|---|---|---|---|
| Flowering | 0.64* | - | | | | |
| Mean yield | 0.74** | 0.12 | - | | | |
| Nut weight | -0.07 | -0.55 | 0.15 | - | | |
| Shelling | 0.22 | 0.79** | -0.33 | -0.67* | - | |
| Canopy spread (EW) | 0.10 | 0.65* | -0.49 | -0.52 | 0.70** | 0.99*** |
| Canopy spread (NS) | 0.05 | 0.62* | -0.55 | -0.48 | 0.70** | 0.98*** |

# Remarks I

- We observed high heritability estimates (0.43 - 0.93) for flowering intensity which shows the inherent genetic control of flowering.

- Since there is a large potential to manipulate its expression it could be an important trait for selection.

- There were significant positive correlations observed between flowering intensity and other yield related component (cumulative yield, shelling, canopy spread EW, canopy spread -NS).

- This suggests that cashew progenies may employ accelerated flowering intensity rate to evade drought stress to ensure high yields.

# Remarks II

- Progenies SG 266 × TAN 992 and BE 059 × TAN 992 were superior by combining high flowering intensities with wider canopies, higher cumulative and mean yields with better nut quality.

- There is the potential for considerable gains to increase yield of cashew in high drought prone environments by accelerated flowering intensities. This would be important in the West African sub-region, where cashew is cultivated in the semi-arid areas.

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