STUDIES ON DROUGHT SUSCEPTIBILITY OF CORCHORUS OLITORIUS L. : I. EFFECTS OF STRESSING PLANT AT MIDVEGETATIVE STAGE ON DRY MATTER YIELD AND YIELD COMPONENTS OF TWO CULTIVARS OF C. OLITORIUS

Ayodele, V. I.
Department of Agronomy University of Ibadan

Fawusi, M. O. A.
Department of Agronomy University of Ibadan

出版情報：BIOTRONICS. 18, pp.23-27, 1989-12. Biotron Institute, Kyushu University
バージョン：
権利関係：

BIOTRONICS **18**, 23–27, 1989

STUDIES ON DROUGHT SUSCEPTIBILITY OF *CORCHORUS OLITORIUS* L. I. EFFECTS OF STRESSING PLANT AT MID-VEGETATIVE STAGE ON DRY MATTER YIELD AND YIELD COMPONENTS OF TWO CULTIVARS OF *C. OLITORIUS*

V.I. AYODELE and M.O.A. FAWUSI

Department of Agronomy, University of Ibadan, Ibadan, Nigeria

(Received September 4, 1989; accepted September 6, 1989)

AYODELE V. I. and FAWUSI M. O. A. *Studies on drought susceptibility of* Corchorus olitorius *L. I. Effects of stressing plant at mid-vegetative stage on dry matter yield and yield components of two cultivars of* C. olitorius. BIOTRONICS **18**, 23–27, 1989. A greenhouse experiment was conducted to evaluate the effects of soil water potential of −6 bar imposed at the mid-vegetative stage on two cultivars of *Corchorus olitorius* ('Angbadu' and 'Oniyaya'), both indigenous to Nigeria. The objective was to determine the differential tolerance of the two cultivars to soil moisture stress. The two cultivars differed significantly in their responses to soil moisture stress. Leaf area of 'Angbadu' plants was significantly reduced by soil moisture stress, while the reduction observed in 'Oniyaya' was not significant. 'Oniyaya' plants were more tolerant to soil moisture stress. It produced higher fresh weight and dry matter yields than 'Angbadu'. This is attributable to smaller leaves and greater average root length of 'Oniyaya' which helped in controlling excessive transpirational losses and exploit soil moisture while maintaining higher dry matter accumulation.

Key words: *Corchorus olitorius* L; drought susceptibility; soil moisture stress; tropical leafy vegetable.

INTRODUCTION

Leafy vegetables are of considerable importance in the tropics, where staple diets consist of starchy foodstuffs like rice, cassava, maize and yams. These are complemented with leafy vegetables which are rich sources of vitamins, minerals and proteins (*2*, *6*). Jew's mallow; *Corchorus olitorius* L. is an important leafy vagetable in Nigeria and it is propagated by seed. The leaves provide greens or pot herb after blanching in hot water. They have comparatively lower ascorbate but higher dry matter contents than many other tropical leafy vegetables (*3*). There is considerable seasonal variation in the quantity of this leafy vegetable in most parts of West Africa, because production is largely rain-fed. In the dry season, the quantity becomes very low, and quality poor. The dry season in Nigeria is

characterised by 3–4 months of rainless period and severe soil moisture stress of varying degrees depending on the ecological zone. This study is therefore, an attempt to determine the effects of repeated cycles of soil moisture stress on vegetative yield of two cultivars of *Corchorus olitorius* with a view to determining their differential tolerance to cycles of severe soil moisture deficit and identify which cultivar will perform better under semi-arid ecological zones.

MATERIALS AND METHODS

Black polythene bags (41 × 36 cm), each filled with 15 kg of air-dried sieved sandy soil were arranged in a green house in the Department of Agronomy, University of Ibadan, Ibadan, following a completely randomised design. A basal dressing of 60 kg N/ha in form of 15-15-15 NPK fertilizer was applied and thoroughly mixed with the soil. The physical and chemical properties of the soil are as in Table 1. Seeds of *Corchorus* cultivars 'Angbadu' and 'Oniyaya' which had been previously parboiled by steeping in warm water for 10 seconds and air-dried were broadcast at the rate of 20 seeds per pot. Soil was kept moist to encourage germination and seedling growth. Seedlings were thinned to 2 per pot and gypsum blocks were sunk to 15 cm depths to monitor soil moisture stress which involved allowing the soil to dry down to −6 bar tension before being recharged to field capacity. The stress cycle was repeated three times. Stress treatment was imposed at mid-vegetative stage that is 7 to 10 weeks after seeding.

Plant height and leaf and branch number were measured and counted weekly, while leaf area, root length, fresh and dry weights of stem, lamina, and petiole were determined at final harvest.

RESULTS AND DISCUSSION

Vegetative growth

Severe soil moisture stress (−6 bar) markedly reduced plant height for both cultivars as soon as it was imposed (Fig. 1a). During the period of stress (8–10 weeks after seeding), the unstressed 'Angbadu' plants were significantly taller than plants in other treatments, but insignificant at harvest, five weeks after stress alleviation. In terms of plant height, 'Angbadu' plants were more susceptible to stress than 'Oniyaya.'

Leaf production by the two cultivars was not significantly affected by soil moisture stress imposed at mid-vegetative stage of growth (Fig. 1b). 'Oniyaya' plants, however, produced more leaves per plant than 'Angbadu', indicating better tolerance to stress with regards to leaf production. Stress did not significantly

Table 1. Soil physical and chemical properties

Sand-silt-clay (%)	pH (in $CaCl_2$)	Org. C. (%)	Total N (%)	Avail. P (ppm)	Exch. K (meq/100 g)
87-8-5	6.60	1.37	0.12	10.60	0.50

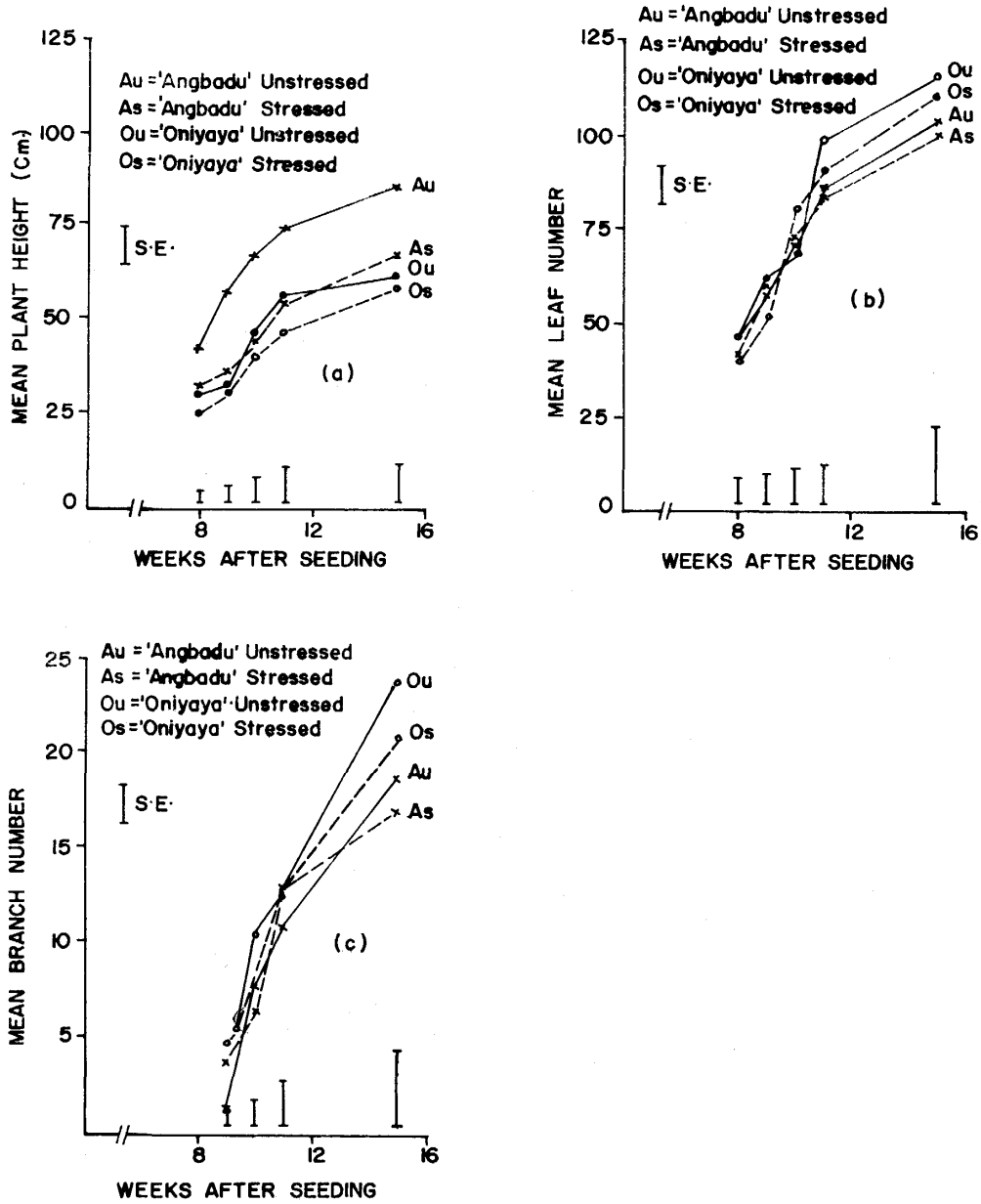

Fig. 1. Response of plant height, leaf number and branch number of *Corchorus olitorius* to soil moisture stress.

affect branching (Fig. 1c). Lack of significant response to stress at harvest in terms of plant height and leaf number in both cultivars could be attributed to compensatory growth in plants recovering from temporary water deficit (*1*).

Whereas leaf number was not significantly affected by soil moisture stress, soil moisture deficit significantly reduced leaf area in 'Angbadu' (Table 2). Leaf production was therefore, less sensitive to stress than leaf expansion. A similar phenomenon was reported by Fischer and Hagan (5). The mid-vegetative stage is

Table 2. Effect of stressing plants at mid-vegetative stage on leaf area and root length of *Corchorus olitorius*

Soil water potential	Cultivar	Leaf area (cm^2)	Relative reduction (−0.2 bar)	Root length (cm)	Relative reduction (−0.2 bar)
−0.2 bar	'Angbadu'	65.00		31.10	
	'Oniyaya'	36.50		40.25	
−6.0 bar	'Angbadu'	56.00	13.85	10.50	66.24
	'Oniyaya'	31.88	12.66	25.20	37.39
LSD (0.05)		8.46		8.60	

Table 3. Effect of stressing plants at mid-vegetative stage on fresh weight of different plant parts of *Corchorius olitorius*

Soil water potential	Cultivar	Fresh weight (g/plant)					
		Stem	Lamina	Petiole	Root	Pod	Whole plant
−0.2 bar	'Angbadu'	23.00	12.94	3.15	13.67		52.76
	'Oniyaya'	29.25	16.60	1.85	7.13	10.25	65.08
−6.0 bar	'Angbadu'	22.78	20.78	2.35	5.70		51.61
	'Oniyaya'	28.34	15.99	1.64	5.01	7.93	58.91
LSD (0.05)		5.83	4.66	0.60	1.80		8.56

All stressed plants were allowed to establish well till the mid-vegetative stage before imposing water stress.

Table 4. Effect of stressing plants at mid-vegetative stage on dry weight of different part parts of *Corchorus olitorius*

Soil water potential	Cultivar	Dry weight (g/plant)					
		Stem	Lamina	Petiole	Root	Pod	Whole plant
−0.2 bar	'Angbadu'	5.86	3.54	0.50	3.59	—	13.49
	'Oniyaya'	6.88	4.88	0.55	2.70	5.90	20.91
−6.0 bar	'Angbadu'	3.26	4.58	0.32	2.52	—	10.68
	'Oniyaya'	6.40	4.63	0.45	2.06	4.59	18.13
LSD (0.05)		1.72	N.S.	N.S.	0.85		3.28

All stressed plants were allowed to become well established until the mid-vegetative stage before imposing water stress.
N.S. stands for not significant at 5% level of probability.
— no pods.

a period of flower initiation characterised by rapid leaf expansion to meet sink demands. Stress did not significantly reduce leaf size in 'Oniyaya'; it is, therefore, more tolerant to soil moisture deficit.

Root elongation was significantly retarded by soil moisture stress in both cultivars (Table 2). Availability of soil moisture is highly essential for physiological activities particularly in the root and the plant in general. A similar observation was reported by Robertson *et al.* (7), in irrigated corn. 'Angbadu' plants were, however, more susceptible to soil moisture stress as, 66% reduction was observed as compared with 37% in 'Oniyaya.'

Fresh and dry weights

The petiole and root fresh weights were greatly reduced by moisture stress in both cultivars. The unstressed 'Angbadu' plants which had significantly lower lamina fresh weight had compensatorily higher petiole fresh weight (Table 3).

The whole plant fresh and dry weights of the two cultivars were not significantly affected by soil moisture stress (Tables 3 and 4). This could be due to growth recovery after stress alleviation. A similar phenomenon was observed by Fawusi *et al.* (*4*) in *Corchorus olitorius* in a controlled environment. In spite of the greater mean plant height and leaf area in 'Angbadu', cultivar 'Oniyaya' plants produced significantly greater fresh and dry weights. This observation could be due to the fact that the smaller leaves in 'Oniyaya' helped in controlling excessive transpirational losses; and its longer roots facilitated soil moisture exploitation while maintaining higher dry matter accumulation. The fact that 'Oniyaya' plants flowered and produced pods could partly account for its significantly higher whole plant dry and fresh weight.

REFERENCES

1. Begg J. E. and Turner N. C. (1976) Crop water deficits. *Advances in Agron.* **28**, 161–207.
2. Fafunso M. and Bassir O. (1976) The comparative assessment of the protein quality of some Nigerian edible leaves with that of soybean. *Plant Foods for Man* **2**, 35–40.
3. Fafunso M. and Bassir O. (1977) Variation in the loss of vitamin C in leafy vegetables with various methods of food preparation. *Food Chemistry* **2**, 51–55.
4. Fawusi M. O. A., Ormrod D. P. and Eastham A. M. (1984) Response to water stress of *Celosia argentia* and *Corchorus olitorius* in controlled environments. *Scientia Horticulturae* **22**, 163–171.
5. Fischer R. A. and Hagan R. M. (1965) Plant water relation, irrigation management and crop yield. *Exp. Agric.* **1**, 161–177.
6. Oyenuga V. A. (1968) Pages 16–32 *in Nigerian Foods and Feeding Stuff: Their Chemistry and Nutritive Value.* Ibadan Univ. Press, Ibadan.
7. Robertson W. K., Hammond L. C., Johnson J. T. and Boote K. J. (1980) Effects of plant-water stress on root distribution of corn, soybeans, and peanuts in sandy soil. *Agron. J.* **72**, 548–550.