THE EFFECT OF IRRIGATION RATES AND NITROGEN AND PHOSPHORUS FERTILIZERS ON FIBER CHARACTERISTICS OF GOSSYPIUM HIRSUTUM L. COTTON*

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ABSTRACT

This article reports the estimated relationships between fiber properties of the Acala 4-42 cultivar and N- and P-fertilizers and irrigation. Increasing water rates in the range of 4200-7200 m$^3$/ha weakened the tensile strength of the fibers and increased their fineness; the regression of maturity, length and uniformity ratio was curvilinear: positive on initial rates and negative on those exceeding 5800 m$^3$/ha.

N-fertilizer favorably affected all fiber properties determined: fineness and upper quartile length throughout the rate range tested but strength, mean length and uniformity ratio only up to 250-500 kg ammonium sulfate per ha.

The most favorable effect of P-fertilizer was in considerably increasing the length uniformity ratio; it also increased length and fineness but suppressed the maturity index.

INTRODUCTION

The genetically controlled fiber properties (2,5) are subject to wide environmental variations: they were shown to be affected to a large extent by fluctuations in temperature levels (4). Inconsistent results were obtained with fertilizer elements and irrigation rates; ranging from lack of any effect (3,6) to some favorable (8,9) or even detrimental (1) effects on some of the fiber characteristics.

The aim of this work was to investigate the relationships between rates of irrigation water and N- and P-fertilizers on several fiber properties of the cultivar Acala 4-42 (G. hirsutum L.)

MATERIALS AND METHODS

The experimental factors were tested in two separate field experiments.

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Experiment 1.

Five water levels: 4200, 5200, 5800, 6200 and 7200 m$^3$/ha were tested in a four-replicated randomized block design. These water rates were given in addition to 300 mm rain, the major part of which fell during the early winter months. In order to restore the water deficit to field capacity in a soil profile of 150 cm, the experimental plot was pre-irrigated with 1000 m$^3$ water/ha on March 15. The remaining amounts of water were applied in seven sprinkler irrigations, carried out at evenly spaced intervals but with differential rates according to the treatment.

The experimental plot was fertilized with 350 kg ammonium sulfate, 100 kg urea, 1200 kg single superphosphate and 100 kg potassium chloride, applied partly before sowing and partly as a top dressing. The experiment was carried out on an aeolian fluviatile loess soil of clay-loam texture, situated at 3132 N lat., 3436 E long., 80 m elevation. Sowing was carried out on March 27 and samples for fiber tests were taken at the first picking (4/I).

Experiment 2.

Levels of 0, 200, 400 and 600 kg ammonium sulfate and 0, 400, 800, and 1200 kg single superphosphate per ha were tested in a four-replicated randomized block design on a brown alluvial soil type of a clay-loam texture, situated at 3200 N lat., 3450 E long., 40 m elevation. A total rainfall of 449 mm, satisfactorily distributed over the winter months, wetted to field capacity a soil profile of 180 cm; this was supplemented with 4000 m$^3$ water/ha, applied during the growing season. Sowing was carried out on May 5, and samples for fiber tests were taken on September 22.

The fiber samples were tested for mean length (ML), upper quartile length (UQL), uniformity ratio (UR), tensile strength, fineness and maturity. Length was determined with a Fibrograph and is expressed in inches; strength — with the Pressley flat bundle strength tester and is expressed in lbs/mg; fineness in microgram/inch, and maturity in per cent, were determined with a Micronaire instrument by the Causticaire method, before and after treatment with sodium hydroxide, respectively (7).

The relationships between the fiber properties and the independent variables were estimated by the general polynomial regression equation.

RESULTS

The regressions of the fiber properties on irrigation rates are presented in Fig. 1; those on N- and P-fertilizers rates — in Fig. 2; and the regressions of yield of seed-cotton and lint percentage on water rates — in Fig. 3.