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# INHERITANCE OF PROTEIN AND LYSINE CONTENTS IN GRAIN SORGHUM

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## ABSTRACT

**Protein and lysine content were studied in a 7-parent diallel of sorghum. While both additive and nonadditive gene actions were responsible for the inheritance of protein %, dominance-based epistasis was mainly responsible for the inheritance of lysine content. The parents IS 11758, IS 11167 and W 5 were identified as desirable combiners for these traits.**

**Key words:** Sorghum, inheritance, diallel cross, protein, lysine.

The protein quality of sorghum is poor in terms of amino acid balance. Attempts to improve nutritional quality in sorghum would hence involve increasing the concentration of essential amino acids, particularly, lysine and protein. The pattern of inheritance and relevant genetic information on protein and lysine content are investigated in the present study.

## MATERIALS AND METHODS

Seven varieties of sorghum, CSV 3, CSV 4, CSV 5, W 5, OSW 5, IS 11758 and IS 11167, were diallel-mated to produce both direct and reciprocal crosses. The 42 $F_1$ and 7 parents were planted at Sorghum Research Station, Parbhani, during the monsoon season of 1979-80 in randomised block design with two replications in single-row plots, 3m long; the row-to-row distance was 45 cm. The crop was grown under normal agronomic practices. Grains from 10 randomly selected panicles per entry were used to estimate protein and lysine contents using a modified procedure of Udy [1]. Combining ability analysis was done using Method I, Model I of Griffing [2].

## RESULTS AND DISCUSSION

The two Ethiopian lines, IS 11167 and IS 11758, recorded highest protein and lysine content (Table 1). Their hybrid IS 11758 × IS 11167 also exhibited highest protein and high lysine content, followed by cross IS 11758 × W 5. Wide variability from 10.4 % (CSV 5 × CSV 3) to 17.0 % (IS 11758 × IS 11167) protein was observed in the hybrids. The three parents involved in producing high-protein high lysine hybrids themselves had high protein and high lysine, but were low yielding and their grains were either coloured or chalky (like wani). Hence the high-lysine line combination with high yielding parent like CSV 5 may produce hybrid with high grain yield and high protein content.

**Table 1. Mean performance of selected hybrids and parents for protein and lysine content**

| Cultivar | Protein, % | | Lysine, % | |
|---|---|---|---|---|
| | direct | reciprocal | direct | reciprocal |
| **Hybrids:** | | | | |
| IS 11758 × IS 11167 | 17.0 | 16.4 | 3.38 | 3.22 |
| W 5 × IS 11758 | 16.0 | 16.6 | 2.55 | 2.79 |
| CSV 3 × IS 11758 | 16.0 | 16.0 | 2.03 | 2.39 |
| CSV 4 × IS 11758 | 15.9 | 16.2 | 2.08 | 2.26 |
| CSV 5 × IS 11758 | 15.8 | 16.0 | 2.26 | 2.33 |
| W S × IS 11167 | 15.6 | 14.3 | 2.70 | 2.30 |
| OSW 5× IS 11758 | 15.2 | 15.2 | 2.33 | 2.33 |
| OSW 5× IS 11167 | 15.0 | 15.0 | 2.35 | 2.27 |
| **Parents:** | | | | |
| IS 11758 | 16.6 | | 3.00 | |
| IS 11167 | 16.1 | | 3.18 | |
| W 5 | 13.5 | | 1.92 | |
| OSW 5 | 13.0 | | 1.83 | |
| SE | 0.23 | | 0.01 | |
| CD at 5% | 0.69 | | 0.02 | |

The variation due to general and specific combining ability (gca, sca) and reciprocal effects were highly significant for protein and lysine content (Table 2). Thus there was indication of high maternal effects. This was possible since lines with high protein and lysine (IS 11758 and IS 11167) produced hybrids with high protein and lysine content, when used as mother parent. Maternal effects for quality traits were also reported earlier [3, 4]. Further, the estimates of heritability were high for protein and lysine content.

**Table 2. Combining ability analysis for protein and lysine in grain sorghum**

| Source | d.f. | F test | | Variance estimates | |
|---|---|---|---|---|---|
| | | protein | lysine | protein | lysine |
| gca | 6 | * | * | 1.87 | 0.09 |
| sca | 20 | * | * | 0.90 | 0.04 |
| Reciprocal | 21 | * | * | 0.16 | 0.07 |
| Error | 96 | 0.03 | 0.01 | | |
| $h^2$ | | | | 67 | 68 |

*Significant at 5% level.

The two Ethiopean lines, IS 11758 and IS 11167, exhibited positive and highly significant gca effects for both the traits. Most cross combinations involving either IS 11758 or IS 11167 as one of the parents had positive sca effects for protein and lysine content.

**Table 3. The gca, sca and reciprocal effects of a few crosses found superior in protein and lysine content**

| Cross | Protein content | | | | Lysine content | | | |
|---|---|---|---|---|---|---|---|---|
| | gca | | sca | reci-procal | gca | | sca | reci-procal |
| | M | F | | | M | F | | |
| CSV 3 × IS 11758 | 2.30 | −0.37 | 0.70 | −0.20 | 0.42 | −0.28 | 0.32 | −0.18 |
| CSV 3 × IS 11167 | 1.67 | −0.37 | 0.80 | −0.29 | 0.48 | −0.28 | 0.29 | −0.64 |
| CSV 4 × W 5 | 0.41 | −0.26 | 0.35 | −0.46 | −0.10 | −0.16 | 0.21 | −0.03+ |
| OSW 5 × IS 11758 | 2.30 | −0.88 | 0.76 | −0.69 | 0.42 | 0.10 | 0.17 | −0.23 |
| IS 11758 × IS 11167 | 1.67 | 2.30 | −1.69 | 1.03 | 0.48 | 0.42 | 0.23 | 0.48 |

M—male, F—female; all values except + significant at 1% level.

Ten hybrids had highly positive and significant sca effects for protein % and eight for lysine %. Hybrids showing positive sca effects for protein and lysine content included, in most cases, an Ethiopian high-protein line as one of the parents. The only exception was cross CSV 5 × W 5, which had positive sca effects for both the traits. However, it was a cross between two poor combiners.

Three hybrids, CSV 5 × OSW 5, CSV 4 × IS 11167, and IS 11758 × IS 11167, showed significant positive reciprocal effects for protein and lysine content. A study of the combinations showing significant reciprocal effects for either or both traits suggests that high protein and high lysine lines would be a useful source as pollinators, as was noted earlier [3, 5].

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