

Development of protein rich tetraploid oat- current state and prospects

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- *Avena magna* has the highest protein content (23%-27%) of all oat species
- The transfer of this protein content to the common oat is hindered by:
 - Difference in chromosome numbers ($2n=28$ in *A. magna* and $2n=42$ in *A. sativa*) resulting in hybrid self sterility but some seeds may be produced by pollination with parental pollen
 - Protein content is a trait of quantitative nature

New approach to exploit *A. magna* protein content

- Domestication: transferring the domestication syndrome of *A. sativa* to *A. magna*
- Domestication syndrome : A small number of traits that makes the difference between wild and domesticated state
- In oats, fundamental character of this syndrome is seed non-shattering at maturity, accompanied by glabrous and yellow lemmas and reduction of awns number and size and erect growth

Genetics of domestication syndrome characters

- Each of these traits shows mono-genic inheritance
- Some of the characters are linked to each other
- As a result of this inheritance, the domestication syndrome can be transferred via the pentaploid bridge, in spite of the severe sterility of the hybrids

The experimental procedure: first hybridization cycle

- 1. Crosses of *A. sativa* x *A. magna*
- 2. F1 x *A.magna* (wind pollination)
- 3. BC plants exhibit variation in fertility (0-20%) and chromosome numbers (28-32).
- 4. F2, BC selection of individuals for the next cycle

Second hybridization cycle

- 1. *A. sativa* x Hybrid derivatives (2n=28)
- 2. F1 x Hybrid derivatives
- 3. BC, no wild phenotypes occur, selection for fertility
- 4. F2,BC, selection for fertility and individuals for initiating the third cycle
- The same procedure for the 4th and 5th cycles

Outcome of the hybridization cycles

$2n=28$ plants are morphologically indistinguishable from the common oat





THE PROTEIN

- 1. Protein content varied (16%-23%) among progeny of the 5th hybridization cycle
- 2. Individuals with the highest protein values were crossed again to wild *A. magna*
- 3. F1 hybrids were fertile
- 4. Individuals with wild phenotypes were eliminated in F2
- 5. Individuals with the highest protein contents were crossed with one another and the segregating generations have been reared by single seed descent(now at F4)

Germplasm enhancement of the $2n=28$ oat

- Number of traits are being introduced now to the domesticated $2n = 28$ oat:
- **Semi dwarf stature**
- **Day length insensitivity**
- **Naked seed**

The future of domesticated $2n=28$ oat

- 1. Domesticated $2n=28$ oat can be established as a crop if its protein yield would be superior to any common oat cultivar
- 2. Attaining the highest protein content per land unit can no longer be a one-man's project and requires collaborative efforts.

Contact Information

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