Dependence of Seed Yield of Double Low Winter Oilseed Rape upon Yield Components

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INTRODUCTION

Genetic, habitat and agronomical factors participate in development of plant morphological character what considerably influence yield level. Yield of oilseed rape is directly dependent on number of pods per area unit and weight of seeds per pod. These two basic yield components are conditioned by number of plants per sq. m., number of pods per plant, number of seeds per pod and weight of 1000 seeds.

The objective of this study was to assess the effect of yield components on yield level in different environment conditions.

MATERIAL AND METHODS

The effect of yield components on the seed yield of double low winter oilseed rape was investigated in a ten-year (1985-94) field experiment carried out in Przybroda and two pot experiments conducted in 1992-94 in Poznań. The field experiment was laid out in randomized complete block design with four replication. A hundred Polish and foreign cultivars and strains of double low winter oilseed rape were investigated.

Yield of seeds per plot was adjusted to 13% moisture content and then converted to dt/ha. After harvest on each plot at three random 2 metre long sections, the number of plants per area unit was measured. The number of seeds per pod was determined by counting the number of seeds in each of 25 pods sampled from the top, central and bottom of fructiferous bunches. The weight of 1000 seeds was calculated from the weight of 400 seeds taken from the bulk yield samples. Basing on these detailed yield components, the number of pods per area unit and weight of 1000 seeds were determined.

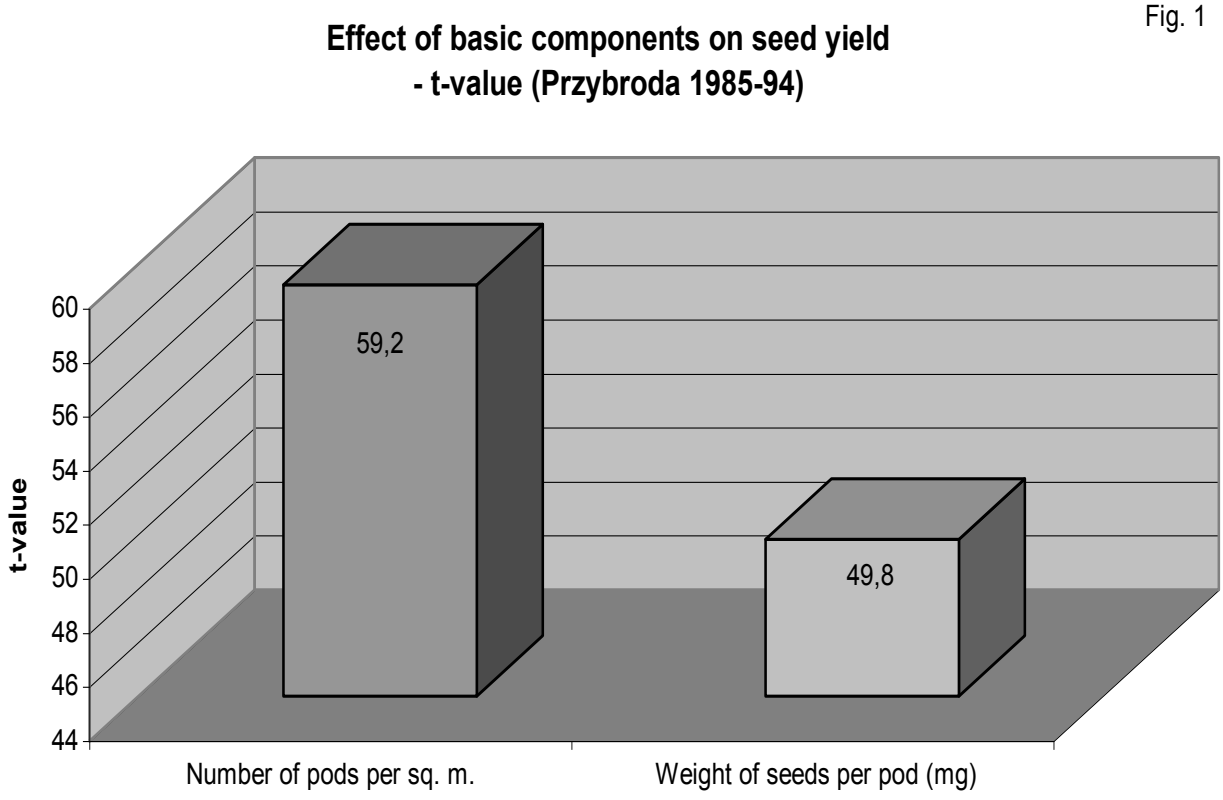
Pot experiments were conducted in a glasshouse in pots on loamy soil in six replications. In the experiment carried out in 1992-93 the effect of nitrogen fertilization level on 7 cultivars

and 1 strains (Bolko, Mar, Samourai, Panter, Tapidor, Liporta, Diadem, PN 2000/90) was investigated. Spring nitrogen fertilization was applied in two doses: 0,8 and 2,4 g N per pot. In the second experiment conducted in 1994 apart from nitrogen fertilization moisture conditions were taken into consideration. Water deficiency treatments were applied in four vegetation stages: stem elongation, budding, flowering, ripening. In this experiment three cultivars (Bolko, Mar, Idol) were compared. As water deficiency the level of 30% of full water capacity of soil was adopted, as compared to the level of 70% of full water capacity of soil in the control treatment. After the harvest the yield, basic and detailed components were calculated.

RESULTS

Yield of oilseed rape was more dependent on the number of pods per area unit than on the weight of seeds per plant (Fig. 1).

Fig. 1

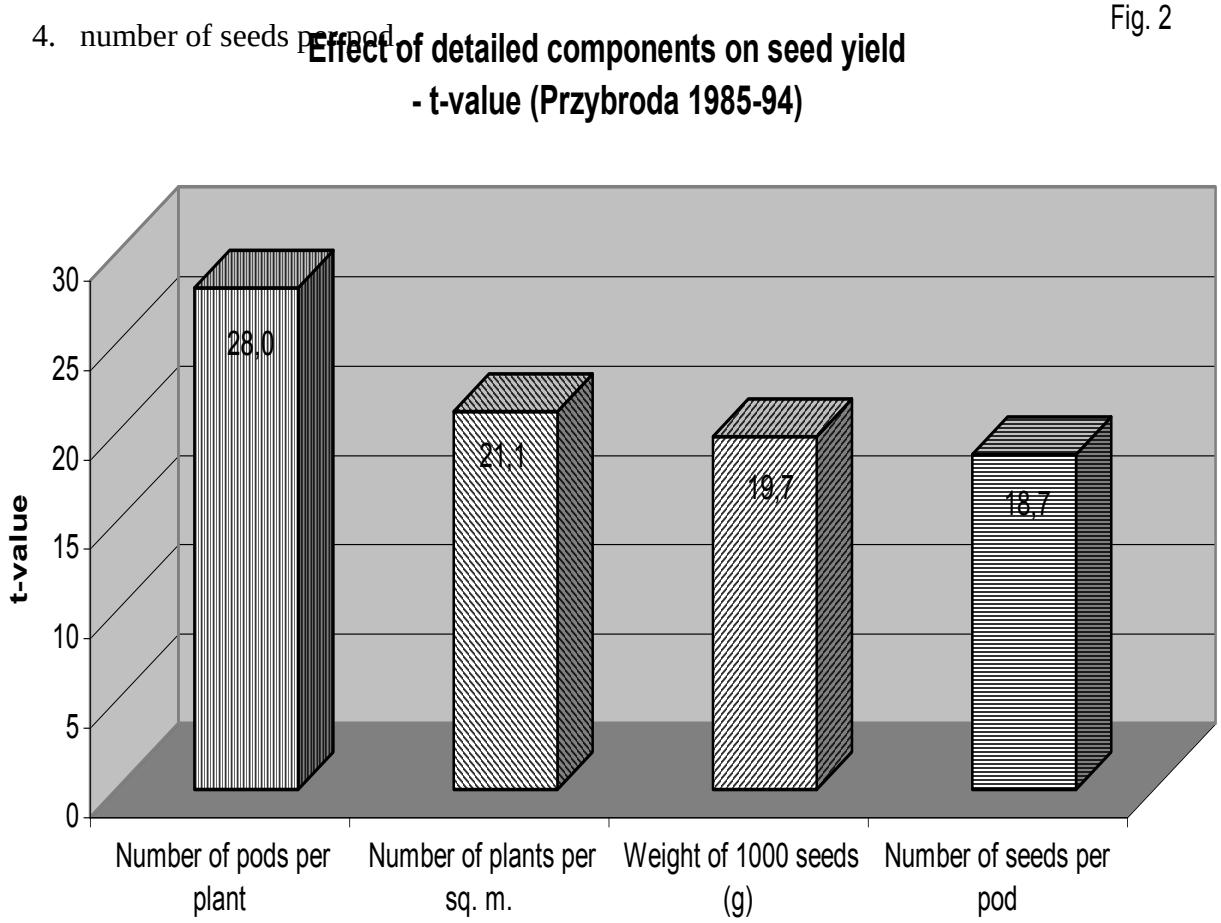


The experiment proved that among detailed components, the number of pods per plant produced the highest effect on the yield (Fig. 2). Effectiveness of detailed yield components can be lined up in such order:

1. number of pods per plant
2. number of plants per area unit
3. weight of 1000 seeds

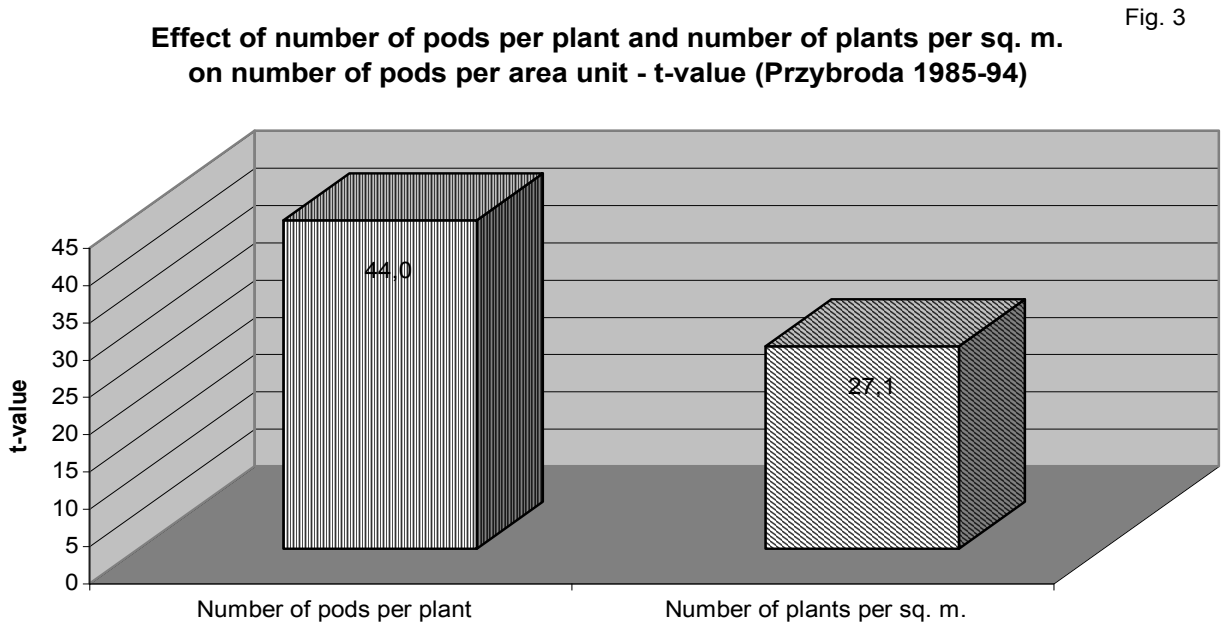
4. number of seeds per pod

Fig. 2



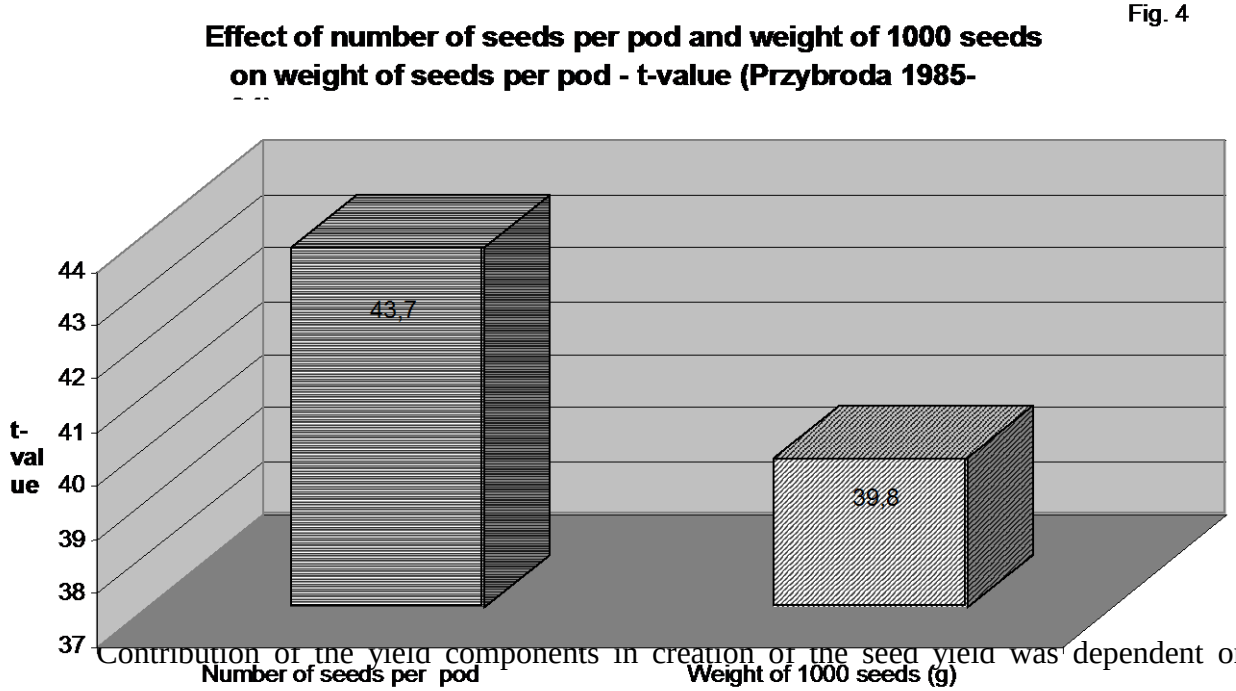
Number of pods per area unit was more dependent on the number of pods per plant than on the number of plants per area unit (Fig. 3).

Fig. 3



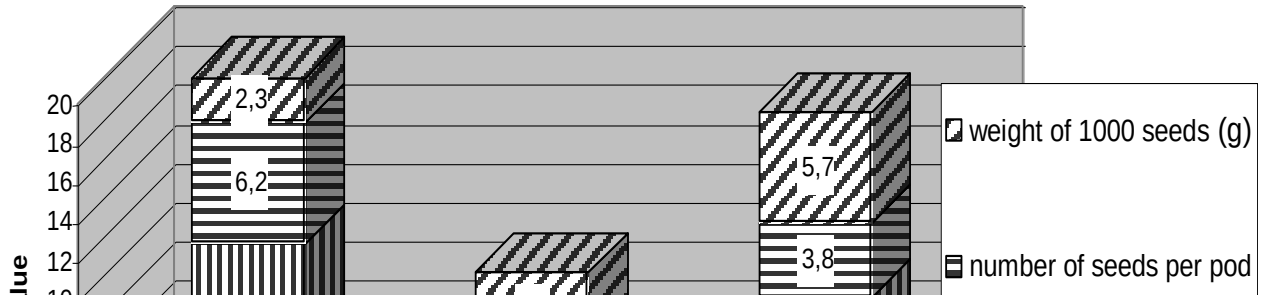
1000 seed weight (Fig. 4).

Fig. 4



Contribution of the yield components in creation of the seed yield was dependent on nitrogen fertilization and water deficiency (Fig. 5). In good water supply conditions nitrogen fertilization had the bigger effect on number of pods per plant and the least effect on weight of 1000 seeds. Water deficiency caused increase of 1000 seed weight importance and decrease of importance of pod number per plant and number of seeds per pod.

Fig. 5



The experiment defines the most desired values of yield components (Table 1). In the Przybroda conditions 60-65 plants per sq. m. was the most favourable plant density. In such density every plant was able to produce 70-80 pods with 23-25 seeds which weight of 1000 seeds was 4,5-4,7 g. It ensured yield level range from 50 to 60 dt/ha.

Table 1

Yield components set together according to seed yield (Przybroda 1985-94)

Yield (dt/ha)	≤ 32,0	32,1-37,0	37,1-42,0	42,1-47,0	47,1-52,0	>52,0
Class size	40	46	53	41	33	35
Number of pods per sq. m.	2992	3617	4427	4937	4709	4860
Weight of seeds per pod (mg)	97,4	96,4	92,3	94,6	109,7	116,2
Number of plants per sq. m.	53,6	58,7	58,3	65,5	64,1	64,8
Number of pods per plant	58,9	65,4	79,9	81,6	75,1	76,6
Number of seeds per pod	22,8	23,2	23,0	23,1	24,9	24,8
Weight of 1000 seeds (g)	4,28	4,20	4,02	4,06	4,44	4,69

DISCUSION

Regression analysis proved the most significant effect of number of pods per area unit and per plant on yield. Muśnicki i Muśnicka (1986) agreed with the opinion on the biggest importance of number of pods per area unit. Shrimpf (1954), Stolle (1954), Olson (1960), Thurling (1974), Musnicki (1989) and Wójtowicz *et al.* (1999) also considered that among the detailed yield components the number of pods per plant is the most essential. This experiment showed a little bigger contribution of 1000 seed weight in creation of the yield than the number

of seeds per pod. Shrimpf (1954) and Stolle (1954) were of an opinion that the number of seeds per pod influenced more the yield than the weight of 1000 seeds. Olson (1960) confirmed these autors' point of view but considered that in creation of yield significance of 1000 seed weight should not be depreciated. Muśnicki (1979) proved that weight of 1000 seeds is more important than the number of seeds per pod.

Analysis of the field and pot experiments results showed that bigger contribution of 1000 seed weight than the number of seeds per pod in yield creation was caused by drought which often occurs in spring in Poland. Similar differentiation of statistic measures between the number of seeds per pod and weight of 1000 seeds in field and controlled water deficiency conditions indicate that plant water needs was not provided in field conditions. Moreover, the experiment showed that nitrogen fertilization decreases negative influence of water deficiency. These results were consistent with those reported by Wałkowski and Dembiński (1993), Barszczak *et al.* (1994), Barszczaka and Barszczak (1995).

The results confirmed the working hypothesis that optimum relation between components is more important in the yield creation than increase of one, even the most essential, component. These results are in an agreement with the previous study of Thurling (1974) and Horodyski (1990).

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