EFFECT OF WATER AND NUTRIENT SUPPLY ON THE YIELD AND PROTEIN YIELD OF PEA

Mrs. M. LESZNYÁK – É. HUNYADI BORBÉLY
Centre for Agricultural Sciences, Debrecen University, Hungary
Department of Crop Production and Applied Ecology

Introduction

The extensive spread of environmental agriculture growth ensures the realization of conservation objectives, the produce of healthy food and feed, the preservation and correction of our natural resources: land , soil, and water supply (Jolánkai M. 1990). The pea is equally important feed and food, it's economic value is getting better (Velich I. and Csizmadia L. 1985). It's value is given by it's 53-60 % carbohydrate and 22-28 % protein-content, which can be especially manipulated by production factors (Győri Z. and Bocz E, 1991; Bocz E. and Győri Z. 1986; Győri Z. 1981, 1988). The ecological needs of peas varieties is different (Csontos Gy. 1992), the nutrient requirement depends on the taken and used amount of nutrient, and the nutrient providing ability of soil. The root of NPK-calculation is the planned size of growth (Kajdi F. and Győri T. 2001).

Methods

The effect of major production factors (forecrop, fertilization, irrigation, soil cultivation) on the yield and protein yield of pea in 1991-2004. was studied in a long-term experiment set up at the Látókép Experimental Nursery of Debrecen University, Centre for Agricultural Sciences, Hungary. The present paper uses the results of these experiments to examine yield and protein production aspects of the causes and consequences of yield of pea. A further aim was to carry out control measurements in order to quantify the vast amount of knowledge available from these experiments.

In the long-term experiment was the forecrop maize, sort Forman, strength density: 1,1 million hectare^{-1}, in chernozem soil (silt + clay content: 50 %; Organic matter: 2,5 – 3,0 (Organic carbon 1,5 %); pH in KCl: 5,5 – 6,5; Whole nitrogen: 0,12 – 0,18 %; Ammonium lactate extracted Phosphorous in P_2O_5: 138 mg kg^{-1}; Ammonium lactete extracted Potassium in K_2O: 270 mg kg^{-1}). The replication number was four, the experimental parcels were 46 m^2. Rainfall in the growing season of pea in 2002 was: 154 mm, in 2003: 180 mm, in 2004: 258 mm, the irrigated water was 50 mm.

Results and discussion

The results of regression analysis and univariate analysis of variance in 2002-2004. led to the following conclusions:

- By right of the results of the long-term experiment, it has been found that the yield of pease is the most affected by the water-supply of the actual year (figure 1.) beside the used volume of fertilizer agent. The plough-cultivation is more suitable for the spring-sow pease, in 14 years average, the soil-preparation with lower disc effected 122 kg ha^{-1} yield-decrease (table 1).
- Between 1991 and 2004 we can observe 182-422 kg ha^{-1} yield-growth at different fertilizer-treatments by the effect of irrigation (107,4-114,7 %) (figure 1.).
- The favourable water-supply promoted larger measure of intake of nutritive substance from the soil, even for the pease that is anyway able to get nitrogen from the atmosphere, and this way it ensured the chance of bigger formation of yield. The yield-excess of using fertilizer correlated to non irrigated and non fertilized parcells is 119-425 kg ha^{-1}, while correlated to irrigated parcels is 230-665 kg ha^{-1} (figure 1.).

DOI: 10.1556/CRC.33.2005.1.26

- The yield of pea is the most affected by the water-supply of the actual year beside the used volume of fertilizer agent and the irrigation (figure 2.). Among the years of 2002-2004, 2004 appears to be the most favourable in point of water-supply, in growing-season of pease there were in excess of many years mean -307,4 mm- fall. At non fertilized parcels this amount of rain was abundant for the claims of pease, and also in the different fertilized parcels the irrigation affected only 101,5-119,9 % yield-excess. The yield increase affect of fertilizing is far better at good water supply (123,7-140,8 %) (figure 2.).
- In 2004 the earlier sowing(19. of March) allowed larger yield mean, also in irrigated, and in non irrigated parcells. The earlier sowing effected without irrigation 547-733 kg ha^{-1},while with irrigation 310-725 kg ha^{-1} yield-growth, correlated to later (26. of March) sowing-time (figure 3.).
- The propitious effect of using irrigating water (50mm), and fertilizing is also shown in protein content increase (figure 4.). In 2002 the protein yield per hectare grown at parcells without irrigation with 102-203 kg ha^{-1} (125-149 %), and in irrigated conditions 88-179 kg ha^{-1} (113-127 %) effected by using fertilizer. The maximized amount of protein (non irrigated: 618 kg ha^{-1}, irrigated: 845 kg ha^{-1}) was reached by using 105 kg ha^{-1} N; 90 kg ha^{-1} P_2O_5; and 90 kg ha^{-1} K_2O.

Table 1: Effect of production factors on the yield of pea in 1991-2004

Fertilizer	N_0:	N_{35}:	N_{70}:	N_{105}:	N_{140}:
yield t ha^{-1}	2,574	2,784	2,994	3,120	3,204
Irrigation	Non irrigated:		Irrigated:		
yield t ha^{-1}	2,742		3,072		
Cultivation	Disc:		Plough:		
yield t ha^{-1}	2,875		2,996		

Scource	Sum of Sq.	df	Mean Sq.	F	$SD_{5\%}$
Year	853059175	13	65619937	281,833	122,10 ***
Irrigation	33103641	2	16551820	71,089	84,25 ***
Soil cultivation	6129996	1	6129996	26,328	46,15 ***
Fertilization	88330767	4	22082692	94,844	72,97 ***
Year x Irrigation	74412205	26	2862008	12,292	211,48 ***
Irrigat. x Fertiliz.	6048377	8	756047	3,247	126,38 ***
Year x Fertiliz.	43325455	52	833182	3,578	273,02 ***
Error	366245417	1573	232832		
Total	15944930481	1680			

***: P = 0,1 %

Figure 1 **Effect of irrigation and fertilization on the yield of pease in various cultivation sequences (Debrecen-Látókép 1991-2004)**

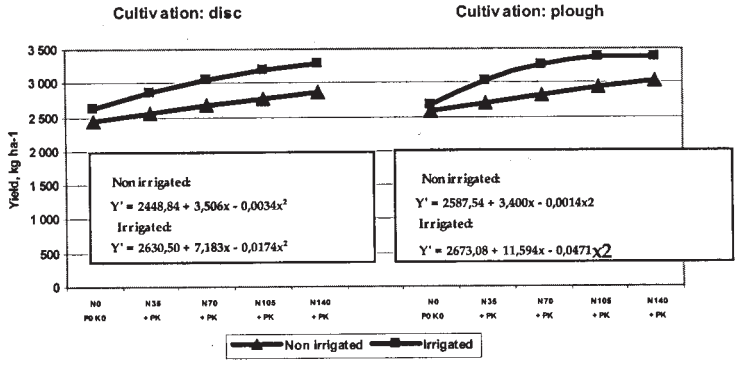


Figure 2 **Effect of irrigation on the yield of pease in various fertilized sequences (Debrecen-Látókép 2002-2004)**

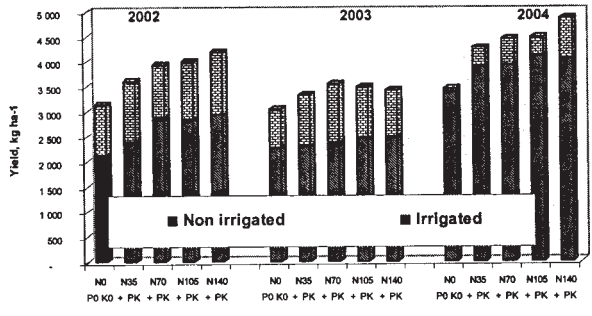


Figure 3 **Effect of sowing time on the yield of pease in various irrigated and fertilized sequences (Debrecen-Látókép 2004)**

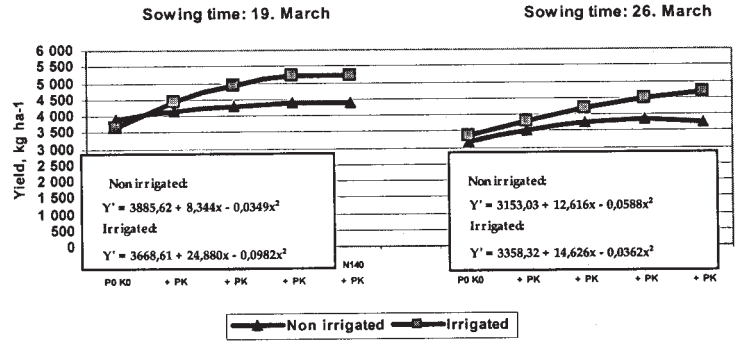
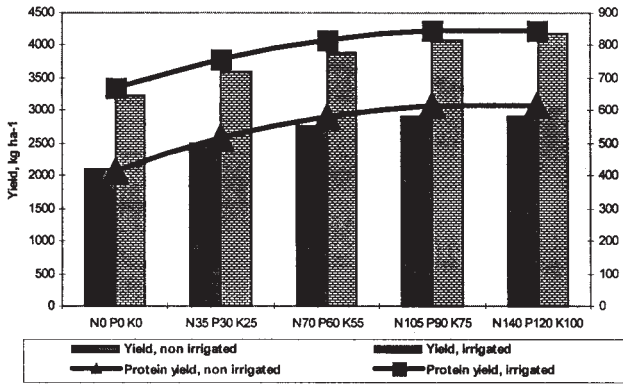


Figure 4 **Effect of fertilization and irrigation on the yield and on the protein yield of pease Debrecen-Látókép, 2002**



References

Győri Z. (1981): A borsó terméssзintje és tápanyagtartalma közötti kapcsolat a műtrágyázás és öntözés függvényében. DATE Tud. Közl. XXI. 89-111.

Velich I. és Csizmadia L. (1985): Zöldbab és zöldborsótermesztés. Mezőgazdasági Kiadó, Budapest, 187-361.

Győri Z. (1988): A műtrágyázás és öntözés hatása a búza, kukorica és borsó aminosav-tartalmára. Tessedik Sámuel Tiszántúli Mezőgazdasági Tudományos Napok DATE, Szarvas, 29-30.

Jolánkai M. (1990): Búzatermesztés és környezetvédelem. Környezetkímélő Búzatermesztési Tanácskozás, Székesfehérvár. 1990. május 30. 5-9.

Győri Z. – Bocz E. (1991): A trágyázás és öntözés hatása a borsó ásványi elem tartalmára és aminosav összetételére. Nitrogéntartalom és aminosav összetétel. Növénytermelés, 40.6. 509-518.

Győri Z. – Kovács B. – A. Lányi – E. Bocz – L. Ruzsányi (1992): The effect of P-fertilization on the microelement content and amino acid composition of pea and corn. 4th International IMPHOS Conference, Belgium, 36.

Csontos Gy. (1992): Zöldborsófajták értékmérő tulajdonságai és az évjárathatás főbb összefüggései. Kandidátusi értekezés. Debrecen.1-16.