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Influence of NPK-application to seed-potato crops on the productivity of the progeny

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Zusammenfassung, Résumé p. 261

Summary

The amount of P- and K-application to the seed-potato crop did not show any influence on the chemical composition of the immature harvested tubers, nor on the productivity if used as seed. Nitrogen had a marked influence on the chemical composition of the tubers.
Seed from plots with high nitrogen dressing showed a tendency to give fewer main stems. Concerning the productivity of the seed the experiments showed contradictory results. It is concluded that the amount of fertilizer applied to the seed-potato crop is of little importance for the productivity of the progeny.

Introduction

The value of seed-potatoes is, as is generally known, mainly determined by their health. Virus-diseased seed mostly produces low yielding plants. Infection by fungi (e.g. *Rhizoctonia solani*, *Fusarium* spp., *Helminthosporium solani*) is often the cause of a bad emergence and poor development of the plants. This may lead to yield depressions. Besides these seed-borne diseases there may be other causes for low productivity of seed, such as temperature and manuring in the growing season. According to Wenzl (1950) a high temperature during the growth of the crop may lead to the development of many thin sprouts (hair sprouts) on the tubers when planted or pre-germinated the next season. Went (1959) found that the production of the progeny was influenced by the temperature in the growing season of the parent plants, low temperatures giving seed with a higher productivity than did high temperatures.
Much research has been done on the influence of fertilizer application on growth and development of the progeny. Emilsson (1949) found no influence on the length of the dormant period, although he observed differences in chemical composition, due to the amount of applied fertilizer. Other research workers observed earlier sprouting

* Retired in 1965.

of the tubers if much nitrogen had been given to the crop (Kottmeyer, 1927; Wünscher, 1952; Hofferbert and zu Putlitz, 1956).

Even the first development of the plants might be influenced by the nitrogen dressing of the previous crop (Wünscher, 1952; Hofferbert and zu Putlitz, 1956; Krüger, 1951). With increasing balanced manuring Pfeffer (1959) observed earlier sprouting and emergence and a more rapid juvenile development. He ascribes these influences mainly to the nitrogen component in the fertilizers, as the difference in germination and development run parallel to the differences in protein content of the seed-tubers.

In some cases a favourable influence of phosphorus on germination and juvenile development has also been found (Hofferbert and zu Putlitz, 1956; Brandt and Sessous, 1953). Even variations in chloride application may lead to differences in the quality of seed potatoes (Arenz, 1950; Wünscher, 1952).

Effects on yield have been reported by Hofferbert and zu Putlitz (1956) and Pfeffer (1959). According to the latter these effects mainly occur in cases of unfavourable soil conditions. Other workers (Volkart, 1948; Fischnich, 1957; Reichard, 1964) did not find any influence of the manuring of the seed on its productivity, even when extremely high quantities were given (Fischnich et al., 1962).

In The Netherlands in the past few years attention has been given to this subject. From 1962 to 1967 a number of experiments were done in which seed potatoes from crops with different amounts of fertilizer were used. The results of these experiments regarding the influence of the amount of fertilizer application on growth and yield of the progeny, will be discussed in this paper.

Materials and methods

Experiments done by IBS

From 1962 to 1966 healthy seed of a few varieties was grown in field experiments with different amounts of N, P and K-fertilizers.

Extremely high dosages were given (Table 1). This seed was planted the next year, after cool storage and pre-germination, in a number of replications. Before planting, the chemical composition of the seed was – in most cases – analysed. The experiments – seed growing as well as subsequent productivity – were done on different soils (Table 1).

In some of the experiments the progeny was grown at different nitrogen levels, or harvesting took place at two stages of maturity. Yields were determined after grading into different tuber sizes. In some of the experiments the number of main stems was counted (Table 1).

Experiments done by PAW

In 1964 the variety *Spartaan*, in 1965 the varieties *Spartaan* and *Multa*, and in 1966 the variety *Multa* were grown in one field and dressed with 0 and 200 kg N per ha. The P- and K-application did not differ. This seed production took place in summer (April planting) as well as in autumn (August planting) and was done in order to obtain infor-

mation about the N-application during seed production on the productivity of the progeny.
These experiments were combined with others in which the growth and production of the potato under various conditions and in different periods of the season were studied, for example the time of planting and of harvesting, the plant density and the age of the seed were varied, and again the amount of N-application. These experiments were done in four replications, however, in such a way that two blocks were planted with seed produced with low N-application and two blocks with seed produced with high N-application.
Before planting the chemical composition of the seed was determined (Table 3). Harvesting was done, in the frame of the experiments, at several times and at several stages of development of the crop.
Yields were determined after grading and in most cases the number of main stems was counted.
In all experiments the seed was pre-germinated. In none of the experiments the percentage of virus-diseased plants (leafroll and virus Y) exceeded 2%.

Results

The results of the IBS-experiments are given in Table 1. Mathematical analyses of these data showed that no significant effect of phosphorus and potassium was found in any of the experiments. As Table 1 shows, there was also little or no influence of these elements on the chemical composition of the tubers.
On the other hand, the variations in nitrogen application led to marked differences in the chemical composition of the seed (Table 1 and 3). It is known that nitrogen usually reduces the dry matter content of the tuber, and in fact in all cases in our experiments the DM-content of the seed decreased with increasing nitrogen appliation during its production. The crude protein content, determined in the fresh material or in the dry matter, increased with increasing nitrogen application; so did the NO_3 content. In many cases the crude protein content was doubled, the NO_3 content quadrupled.
The tuber yields of the PAW-experiments are not given. As mentioned before, the experiments in question were done to study some growth and production factors on the potato. The tuber yields show a great diversity due to the varied treatments and therefore it seems of little use to discuss them in the framework of this paper. However, the absolute data of yield are not essential to study the influence of the rate of nitrogen application on the seed. For this, statistical tests of significance were made on the differences between the results from seed produced with different nitrogen dressing, but with the other experimental treatments the same, by means of the 'sign' test. The results of these tests are given in Table 3; those of the same tests, applied to the data of the IBS-experiments, are shown in Table 2.

Table 1. Survey of NPK-applications, chemical analysis of the seed and yield (IBS-experiments 1962 to 1967).

Year, region (and soil), variety[1]	*Application in the previous year*[2]			*Chem. anal. of the seed*[3]					*Number of main stems per plant*[6]		*Total tuber yield*[7] *(kg/are)*				*% weight of tubers > 45 mm*[10]			
	N	*P*	*K*	*DM*[4]	*crude protein*[5]	*NO_3*	*K*	*P*			*harvested immature*[8]		*harvested mature*[9]		*harvested immature*[8]		*harvested mature*[9]	
1962	0	0	0										308				50	
Hornhuizen	120	100	160										306				52	
(silt)[11]	500	100	160										310				61	
Bintje	120	1000	160										297				45	
	120	100	1000										330				50	
					in dry matter[12]				*0 N*	*100N**			*0 N*	*100N**			*0 N*	*100N**
1963	50	120	50	22.3	5.8	0.06	2.03	0.29	5.3	6.5			237	396			45	65
Westmaas	50	120	500	21.0	7.1	0.06	2.24	0.30	5.7	6.0			252	353			51	63
(silt)	300	120	50	18.6	12.4	0.22	2.06	0.31	6.1	5.4			264	406			57	73
Bintje	300	120	500	17.6	11.9	0.22	2.56	0.31	4.8	5,3			259	414			58	73
					in fresh material[13]				*100N*	*200N*	*100N*	*200N*	*100N*	*200N*	*100N*	*200N*	*100N*	*200N*
1965	0	0	0	–	1.12	0.011	0.44	0.048	3.8	4.0	168	266	346	381	56	67	79	74
Westmaas	0	0	1000	–	1.06	0.010	0.42	0.045	3,9	4.5	155**	228	267**	408	48**	63	71**	84
(silt)	0	1000	1000	–	1.09	0.010	0.37	0.045	3.7	4.1	194	233	356	391	49	66	79	83
Bintje	0	1000	0	–	1.26	0.010	0.43	0.052	3.7	4.2	182	251	289	426	53	66	77	87
	500	0	1000	–	2.24	0.041	0.40	0.052	4.0	4.0	205	274	341	426	65	73	83	85
	500	0	0	–	2.16	0.042	0.39	0.037	3.2	3.7	207	250	346	378	67	76	83	88
	500	1000	1000	–	2.20	0.041	0.38	0.038	3.9	3.8	208	249	339	410	58	74	84	86
	500	1000	0	–	2.27	0.036	0.38	0.049	3.6	4.2	209	264	336	435	60	74	82	87
									60N	*150N*			*60N*	*150N*			*60N*	*150N*
1965	0	0	0	–	1.23	–	0.42	0.032	2.5	2.6			449	545			74	81
Renkum	0	0	1000	–	1.15	–	0.45	0.033	2.9	2.9			456	552			67	76
(sand)[14]	0	1000	1000	–	1.22	–	0.44	0.046	2.5	2.7			399	585			79	82
Spartaan	0	1000	0	–	1.22	0.01	0.44	0.050	2.5	2.5			419	563			71	85
	500	0	0	–	2.05	0.05	0.35	0.030	2.3	2.5			429	551			77	84
	500	0	1000	–	1.78	0.04	0.39	0.023	2.4	2.2			421	534			75	84
	500	1000	1000	–	2.09	0.04	0.38	0.047	2.3	2.5			462	545			78	84
	500	1000	0	–	2.09	0.04	0.36	0.056	2.5	2.7			460	595			79	86
1966																		
Westmaas	120	120	160	–	2.23	0.024	0.40	0.04			259		435		21***		65***	
(silt)	120	120	320	–	2.14	0.019	0.36	0.04			251		441		13***		59***	
Bintje	120	120	640	–	2.12	0.018	0.37	0.04			243		423		16***		55***	
	120	240	160	–	2.28	0.026	0.42	0.05			251		434		22***		64***	
	120	480	160	–	2.24	0.021	0.40	0.05			240		435		16***		53***	
	240	120	160	–	2.33	0.031	0.37	0.04			263		421		24***		59***	
	240	240	320	–	2.26	0.019	0.36	0.04			253		426		23***		62***	
	480	120	160	–	2.28	0.038	0.41	0.04			257		438		29***		67***	
	480	480	640	–	2.31	0.024	0.43	0.04			246		425		30***		64***	
											80N	*160N**	*80N*	*160N**	*80N*	*160N**	*80N*	*160N**

1966																
Westmaas	0	120	200						248	255	362	430	7***	11***	29	49***
(silt)	200	120	200						245	266	349	401	11***	14***	24	50***
Multa																
38000 pl./ha																
1966									*80N*	*160N*	*80N*	*160N*	*80N*	*160N*	*80N*	*160N*
Westmaas	0	120	200						277	277	349	411	2***	11***	10***	29***
(silt)	200	120	200						272	267	354	424	7***	16***	16***	38***
Multa																
67000 pl./ha																
1966							*0 N*	*160N**			*0 N*	*160N*			*0 N*	*160N*
Renkum	0	120	200				3.3	4.5			241	422			47	75
(sand)	200	120	200				3.2	4.5			254	466			63	80
Bintje																
1966							*0 N*	*160N*			*0 N*	*160N*			*0 N*	*160N*
Renkum	0	120	200				3.2	4.2			251	470			42	73
(sand)	200	120	200				3.0	4.0			239	431			49	78
Spartaan																
1966					*in dry matter*[12]											
Renkum	0	120	200	21.4	4.5		7.1	7.1			240	418			18	59
	200	120	200	17.9	9.0		5.3	5.8			225	368			27	62
Multa																
1967																
Den Bommel	0	0	0	21.2	6.3	0.02	5.8				363				80	
(silt)	100	80	0	21.5	8.2	0.04	5.7				362				78	
Tanja	200	160	0	19.8	10.6	0.09	6.3				376				82	
40000 pl./ha																
1967																
Den Bommel	0	0	0	21.2	6.3	0.02	5.2				390				75	
(silt)	100	80	0	21.5	8.2	0.04	6.0				397				71	
Tanja	200	160	0	19.8	10.6	0.09	6.5				400				74	
60000 pl./ha																

* Two levels of N-application in the progeny – *Zwei Menge von N-Gaben im Nachbau* – *Deux doses d'application d'azote dans la descendance*
** Two replications – *Zwei Wiederholungen* – *Deux répétitions*
*** % < 50 mm

[1] *Jahr, Region (und Bodentyp), Sorte* – *Année, région (et sol), variété*
[2] *Anwendung im vorhergehenden Jahr* – *Application l'année précédente*
[3] *Chemische Analyse des Pflanzgutes* – *Analyse chimique du plant*
[4] *Trockensubstanz* – *Matière sèche*
[5] *Rohprotein* – *Protéine crue*
[6] *Anzahl Hauptstengel pro Pflanze* – *Nombre de tiges principales par plante*
[7] *Gesamtertrag an Knollen in* – *Production totale de tubercules*
[8] *Unreif geerntet* – *Récolte non mûre*
[9] *Reif geerntet* – *Récolte mûre*
[10] *Gew. % Knollen < 45 mm* – *% poids de tubercules < 45 mm*
[11] *Schluff* – *Limon*
[12] *In der Trockensubstanz* – *En matière sèche*
[13] *In frischem Zustand* – *En matière fraîche*
[14] *Sand* – *Sable*

Tabelle 1. Übersicht über ***NPK-Düngungen****, chemische* ***Analysen*** *des Pflanzgutes und Ertrag (****IBS-Versuche*** *1962 bis 1967).*
Tableau 1. Tableau des applications ***NKP****, analyse chimique des plants et production (essais* ***IBS*** *1962 à 1967).*

Table 2. Statistical analyses of IBS-experiments (1962 to 1967).

Year, region, variety[1]	*N/ha on previous crop*[2] *(kg)*	*Stage of plants at harvesting*[3]	n*	*Tuber yield*[4]: *cases of n in which seed high N > seed low N*[5]		*Significance level sign-test* $(P = 0.5)$[8]		n*[1]	*Number of main stems*[9]	
				total yield[6]	*weight % of tubers > 45 mm*[7]	*total yield*[6]	*weight % of tubers >45 mm*[7]		*cases of n*[1] *in which seed high N > seed low N*[5]	*significance level sign-test* $(P = 0.5)$[8]
1962										
Hornhuizen (silt[10]) Bintje	120 and 500	mature[12]	2	1	2	–	–			
1963										
Westmaas (silt) Bintje	50 and 300	mature	12	9	12	<0.01	<0.01	6	5	>0.10
1965										
Westmaas (silt) Bintje	0 and 500	immature[13]	23	18	22	0.02	<0.01			
		mature	23	17	21	0.05	<0.01	12	6	>0.10
Renkum (sand[11]) Spartaan	0 and 500	mature	24	13	17	>0.10	0.10	24	8	>0.10
1966										
Westmaas (silt) Bintje	120 and 480	immature	3	0	3**	–	–			
		mature	3	2	2**	–	–			
Westmaas (silt) Multa	0 and 200	immature	12	6	10**	>0.10	0.10			
		mature	12	6	8**	>0.10	>0.10			
Renkum (sand) Bintje Spartaan Multa	0 and 200	mature	18	7	14	>0.10	0.05	18	4	0.05
1967										
Den Bommel (silt) Tanja	0 and 200	mature 40000 pl/ha	6	4	3	>0.10	>0.10			
		mature 60000 pl/ha	6	4	4	>0.10	>0.10			
Total			144	87	118	<0.05	<0.01	60	23	0.10

* n–n[1]: Number of fields with different rates of N-application – *n–n*[1]*: Anzahl Felder mit verschiedenen Stickstoffgaben – n–n*[1]*: Nombre de champs avec doses différentes d'azote*

** > 50 mm

[1] *Jahr, Region, Sorte – Année, région, variété*

[2] *N/ha im Pflanzguterzeugungsjahr – N/ha sur culture précédente*

[3] *Pflanzenstadium zur Zeit der Ernte – Stade physiologique des plantes à la récolte*

[4] *Knollenertrag – Production en tubercules*

[5] *Anzahl Fälle bezogen auf n, in denen Ertrag mit hoher N-Gabe > niedriger N-Gabe – Cas de n où plant de haute teneur en N > plant de basse teneur en N*

[6] *Gesamtertrag – Production totale*

[7] *Gew. % von Knollen > 45 mm – Poids en % de tubercules > 45 mm*

[8] *Signifikanzschwelle Zeichentest (P = 0.5) – Degré de signification, seuil de signification (P = 0,5)*

[9] *Anzahl Haupttriebe – Nombre de tiges principales*

[10] *Schluff – Limon*

[11] *Sand – Sable*

[12] *Reif – Mûre*

[13] *Unreif – Non mûr*

Tabelle 2. Statistische Analysen der IBS-Versuche (1962 bis 1967).
Tableau 2. Analyses statistiques des essais IBS (1962 à 1967).

Table 3. Chemical analyses of the seed and statistical analyses of the results of PAW-experiments (1965 to 1967).

Year region variety**[1]	N/ha on previous crop[2] (kg)	Chem. anal. of the seed[3]: % DM[4]	Chem. anal. of the seed[3]: % crude protein in DM[5]	n*	Main stems[6]: cases of n in which 200 N > 0 N[7]	Main stems[6]: sign. level sign-test (P = 0.5)[8]	n[1]*	Total tuber yield[9]: cases of n[1] in which 200 N > 0 N[7]	Total tuber yield[9]: sign. level sign-test (P = 0.5)[8]	n[11]*	Size distribution of the yield***[10]: cases of n[11] in which 200 N > 0 N[7]	Size distribution of the yield***[10]: sign. level sign-test (P = 0.5)[8]
1965-Boekel (sand[11])												
Spartaan S	0	18.1	7.6	48	16	0.05	62	32	> 0.10	56	43	< 0.01
	200	16.9	10.3									
Spartaan A	0	16.9	9.9	20	7	> 0.10	23	9	> 0.10	23	10	> 0.10
	200	16.2	14.1									
1965 Total				68	23	0.02	85	41	> 0.10	79	53	0.01
1966-Boekel (sand)												
Spartaan S	0	19.5	6.6	38	12	0.05	66	29	> 0.10	64	34	> 0.10
	200	17.2	11.8									
Spartaan A	0	18.7	9.1	4	2	–	8	2	> 0.10	8	2	> 0.10
	200	16.9	15.5									
Multa S	0	21.8	4.4	33	6	< 0.01	56	22	> 0.10	52	31	> 0.10
	200	17.7	9.6									
Multa A	0	22.3	6.4	40	9	< 0.01	40	15	> 0.10	37	22	> 0.10
	200	19.6	12.7									
1966 Total				115	29	< 0.01	170	68	0.01 < 0.05	161	89	> 0.10
1967-Boekel (sand)												
Multa S	0	20.5	4.6	28	11	> 0.10	35	14	> 0.10	31	10	0.10
	200	18.6	7.5									
Multa A	0	20.1	7.5	20	9	> 0.10	28	9	0.10	26	9	> 0.10
	200	17.2	14.3									
1967 Total				48	20	> 0.10	63	23	0.05	57	19	0.02
1965/66/67 Total				231	72	< 0.01	318	132	0.01 < 0.05	297	161	> 0.10

* n, n[1], n[11]: Number of fields with 0 and 200 kg N per ha – *Anzahl Felder mit 0 und 200 kg N pro ha – Nombre de champs avec 0 et 200 kg N par ha*

** S spring-planted seed – *Im Frühling gepflanztes Saatgut – Plant mis en terre au printemps*

A summer-planted seed – *Im Sommer gepflanztes Saatgut – Plant mis en terre en été*

*** Weight % of tubers 28, 35, 45 or 55 mm depending upon the stage of development of the crop at harvest – *Gew. % Knollen in den Grössen von 28, 35, 45 oder 55 mm in Abhängigkeit von Entwicklungsstadium des Bestandes bei der Ernte – Poids en % de tubercules de 28, 35, 45 ou 55 mm en fonction du stade de développement de la culture à la récolte*

[1] *Jahr, Region, Sorte – Année, région, variété*
[2] *N/ha im Pflanzguterzeugungsjahr (kg) – N/ha sur culture précédente*
[3] *Chemische Analyse des Pflanzgutes – Analyse chimique du plant*
[4] *TS – % matière sèche*
[5] *Rohprotein in der TS – % protéine crue dans matière sèche*
[6] *Haupttriebe – Tiges principales*
[7] *Anzahl Fälle, bezogen auf n, in denen 200 N > 0 N – Cas où 200 N > 0 N*
[8] *Signifikanzschwelle Zeichentest (P = 0,5) – Degré de signification, seuil de signification (P = 0,5)*
[9] *Gesamter Knollenertrag – Production totale de tubercules*
[10] *Grössenverteilung des Ertrages – Répartition de la récolte par calibre*
[11] *Sand – Sable*

Tabelle 3. Chemische Analysen des Pflanzgutes und statistische Angaben der Ergebnisse der PAW-Versuche (1965 bis 1967).
Tableau 3. Analyses chimiques de plant et analyses statistiques des résultats de PAW (1965 à 1967).

The number of main stems

The tables show a tendency for seed from a crop with a high rate of nitrogen application to produce fewer main stems than seed from a crop with a low rate. In a number of cases the difference proved to be significant ($P < 0.05$). From the literature little is known about the effect of nitrogen on the number of stems of the progeny. Wünscher (1952) found that fertilizers (N, P and K) had a favourable influence on the number of sprouts on the seed.

The size distribution

Differences in the number of main stems may influence the size distribution of the yield. The percentage by weight of tubers larger than a certain size was therefore determined. In the IBS-experiments the grade of > 45 mm was chosen, in the PAW-experiments various sizes were used, depending on the stage of development at harvest. Tests of these quantities sometimes show a significant increase of larger tubers (Table 2 and 3), if seed from a crop with high nitrogen dressing was used.

However, an effect on the size distribution was not found in all cases in which the number of main stems was influenced significantly (e.g. PAW-experiments 1966). By testing the year-totals of the PAW-experiments, thus drawing a greater number of observations into the test, the experiments in 1967 show a significant decrease of large tubers (Table 3). In this year no significant influence on the number of stems was observed. If the total number of observations over all years together is tested, the IBS-experiments show an increase of large tubers in the case of high nitrogen seed (Table 2). In the PAW-experiments no significant differences were found in this respect (Table 3).

The number of tubers was counted only in the PAW-experiments. No influence was found of the number of tubers per main stem.

Total yield

In the IBS-experiments[1] in 1963 and 1965 a significantly higher yield was found in the progeny of seed which had been produced with a high rate of nitrogen application. In the other years no significant differences were found. If all the observations of the IBS-experiments over the years are combined, there is a significant increase of yield with the nitrogen content of the seed (Table 2). The PAW-experiments show a more or less opposite effect. The tests of the results of the separate experiments do not show any significant differences; in testing the year-totals in two of the three years a significantly lower yield was found when seed produced with a high rate of nitrogen was used. Testing the results of the years together also shows, in contrast with the results of the IBS-experiments, a significantly lower yield from seed with high nitrogen content (Table 3).

[1] Except the Renkum – experiment.

Discussion

A general view on the results of these experiments leads to the conclusion that for the productivity of the seed no great value should be given to differences in its nitrogen content.

Although a tendency is shown for fewer main stems to be developed by seed potatoes with a high nitrogen content, this influence seems to be too small to lead to real deviations in yield and size distribution. The contradictory results, obtained in these experiments, can be found also in the literature.

Observations on the crop during the growing season confirm these conclusions. Only in some cases were slight differences observed in development between the progeny of fields with varied nitrogen application; these differences, however, disappeared soon after emergence. These results are in agreement with the observations of other workers (Wünscher, 1952; Hofferbert and zu Putlitz, 1956; Pfeffer, 1959).

It is known that the age of the seed potato plays a role in the germination of the tuber and development of the plant (Kawakami, 1952, 1962; Madec, 1958). The variations in number of stems may be caused by differences in age of tubers from fields with high and low rate of nitrogen application. However, no differences were found in the time at which germination begun.

The disappearance of initial differences in development may indicate that young plants soon after emergence change from feeding from the mother-tuber to uptake of nutrients from the soil.

Experiments elsewhere agree with this assumption. Morris (1967) found that tuber sprouts soon after planting – after the beginning of root-growth – are able to take up nutrients from the surrounding medium and that the competition for nutrients from the mother-tuber could be reduced by supplying nutrients to this medium.

Preliminary experiments of Dijkshoorn (1968, personal communication) showed that plants from tubers of different nitrogen content did not vary in development, although real differences in nitrogen content were found in the young plants after emergence.

The observations that sprouts already having root primordia before planting largely dominate over those – mostly also smaller – without root primordia, with regard to the development into full-grown stems (Schepers and Hoogland, 1968) should also indicate a rapid uptake of nutrients from the soil soon after planting.

Zusammenfassung

Einfluss der NPK-Düngung zu Pflanzgutbeständen auf die Ertragsfähigkeit der Nachkommenschaft

In einer Reihe von Versuchen mit verschiedener Anordnung wurden von 1962 bis 1967 Beobachtungen über den Einfluss der Düngermenge zu Pflanzgutbeständen auf das Wachstum und den Ertrag der Nachkommenschaft gemacht. Die Literatur über dieses Problem zeigt viele Widersprüche. Bei einer Anzahl der besprochenen Versuche, bei denen die Phosphor- und Kalimengen variiert wurden, liess sich weder ein Einfluss dieser Nährstoffe auf die chemische Zusammen-

setzung des Pflanzgutes noch auf den Ertrag des Nachbaus feststellen (Tabelle 1).
Es erwies sich, dass Veränderungen in der Höhe der Stickstoffgabe einen deutlichen Einfluss auf die chemische Zusammensetzung des Pflanzgutes haben; mit einer hohen Stickstoffgabe wurde der Rohproteingehalt oft verdoppelt, der NO_3-Gehalt vervierfacht (Tabellen 1 und 3).
Die Ergebnisse des Nachbaus, statistisch geprüft mittels des Zeichentestes, zeigen eine Tendenz zur Entwicklung von weniger Haupttrieben bei Pflanzgut aus Beständen mit hoher Stickstoffdüngung (Tabellen 2 und 3). In bezug auf den Gesamtertrag und die Grössenverteilung des Ertrages schwankten die Ergebnisse in den verschiedenen Versuchen. In einigen Fällen wurden ein negativer, in andern Fällen ein positiver Einfluss hoher Stickstoffdüngung auf das Pflanzgut festgestellt (Tabellen 2 und 3).
Anfängliche Unterschiede in der Entwicklung der Nachkommenschaft von Pflanzgut mit unterschiedlichem Stickstoffgehalt verschwanden bald nach dem Auflaufen der Pflanzen. Dieses Phänomen dürfte erklärt werden durch eine möglicherweise frühe Aufnahme von Nährstoffen aus dem Boden durch das sich entwickelnde Wurzelsystem, so dass der Einfluss der Mutterknolle dadurch herabgesetzt wurde.

Résumé

Influence de l'application NPK aux cultures de plants de Pomme de terre sur la productivité de la descendance

De 1962 à 1967, dans un certain nombre d'expériences de schéma variable, on a fait des observations sur l'influence de l'apport de fertilisant à la culture sur le développement et la production de la descendance. Sur ce point, la littérature révèle beaucoup de contradictions. Il résulte de l'examen d'un certain nombre d'essais, dans lesquels les apports de phosphore et de potasse ont varié, que ces éléments n'ont aucune influence sur la composition chimique du plant, ni sur la productivité de la descendance (Tableau 1).
Il se révèle que les variations dans l'apport d'azote ont une influence marquée sur la composition chimique du plant; avec un apport élevé de cet élément, la teneur en protéine crue est souvent doublée, la teneur en NO_3 quadruplée (Tableaux 1 et 3).
Les résultats de la descendance, testée statistiquement au moyen de l'épreuve du seuil de signification, montrent une tendance au développement d'un nombre moindre de tiges principales par le plant provenant de récoltes ayant reçu une application élevée d'azote (Tableaux 2 et 3). En ce qui concerne la production totale et la répartition par calibre les résultats varient suivant les essais. On trouve qu'une forte fumure azotée a, dans quelques cas, une influence positive, dans d'autres cas, une influence négative sur le plant (Tableaux 2 et 3).
Les différences initiales dans le développement de la descendance de plants de différentes teneurs en azote disparaissent bientôt après le levée des plantes. Ce phénomène peut être expliqué par le prélèvement des matières nutritives du sol grâce au développement du système radiculaire, l'influence du tubercule-mère étant ainsi réduite.

References

Arenz, B., 1950. Pflanzenernährung und Kartoffelbau. *Landwirtsch. Jahrb. f. Bayern* 27 (5/6): 51–63.
Brandt, J. & Sessous, D., 1953. Bedeutung der Phosphorsäuredüngung für Leistung und Gesundheit der Kartoffel. *Phosphorsäure* 13 (5): 293–311.
Emilsson, B., 1949. Studies on the restperiod and dormant period in the potato tuber. *Acta Agriculturae Suecana* III: 189–284.
Fischnich, O., 1957. Bericht über die Tätigkeit der Forschungsanstalt für Landwirtschaft, Braunschweig-Völkenrode, pp. 30–32.
Fischnich, O., Heilinger, F., Krug, H. & Pätzold, Chr., 1962. Forschung am Pflanzgut der Kartoffel. *Eur. Potato J.* 5 (1): 93–122.

Hofferbert, W. & Putlitz, G. zu, 1956. Kann man durch mineralische Düngung den Nachbauwert der Kartoffeln beeinflüssen? *Kartoffelbau* 7 (6): 112–115.

Kawakami, K., 1952. Physiological aspects of potato seed tubers. *Mem. Hyogo Agric. College* 2: 1–114.

Kawakami, K., 1962. The physiological degeneration of potato seed tubers and its control. *Eur. Potato J.* 5 (1): 40–49.

Kottmeyer, F., 1927. Ertrag und Pflanzgutwert unter Berücksichtigung des Einflusses von N-Düngemitteln und verschiedener Bodenarten. *Kühn-Archiv* 15: 25–196. Dissertation Halle.

Krüger, F. H. 1951. Über den Einfluss einseitiger Düngung auf den Kartoffelbau. *Z. Acker-u. Pflanzenbau* 93: 359–385.

Madec, P., 1958. Le rôle du tubercule-mère dans l'évolution des germes de Pommes de terre. *Ann. Amélior. d. Plantes* 8: 5–30.

Morris, D. A., 1967. Intersprout competition in the potato. II. Competition for nutrients during pre-emergence growth after planting. *Eur. Potato J.* 10 (4): 296–311.

Pfeffer, Ch., 1959. Uber den Einfluss der Düngung auf den Pflanzgutwert von Kartoffeln. *Eur. Potato J.* 2 (4): 238-250.

Reichard, Th., 1964. Der Einfluss der Stickstoff- und Chlorkaliumdüngung auf den Pflanzgutwert von Kartoffeln. *Bodenkultur* 14 (4): 303–312.

Schepers, A. & Hoogland, R. F., 1968. Relation between sprout development in seed potatoes and the number of main stems in the crop. *Jaarboek IBS.*

Volkart, A., 1948. Der Einfluss steigender Stickstoffgaben auf den Saatgutwert der Kartoffeln. *Landwirtsch. Jahrb. d. Schweiz* 62 (1): 83–95.

Went, F. W., 1959. Effect of environment of parent and grandparent generations on tuber-production of the potato. *Am. J. Bot.* 46 (4): 277–282.

Wenzl, H., 1955. Sommeranbau als Massnahme gegen Abbau durch Knollen – übertragbare Kartoffelviren und gegen Fadenkeimigkeitsabbau. *Bodenkultur* 8 (3): 274–306.

Wunscher, Ch., 1952. Über den Einfluss der Düngung auf Leistung und Gesundheit der Kartoffel. *Z. Acker- und Pflanzenbau* 94 (4): 377–421.