

SOWING QUALITY COMPARISON OF SOWING MACHINES

P.FINDURA, J. MAGA, J. PÁLTIK

SLOVAK UNIVERZITY OF AGRICULTURE IN NITRA

Abstract:

Desired bedding of brand seed into soil jointly with appropriate soil and climate conditions forms assumptions of good outgrowth and equally engaged cropstand. We compare the most frequently used sowing machine Becker SE 4-049 with pneumatic sowing mechanism by sowing of sugar beet, Planter II with pneumatic sowing mechanism too and Monopill S sowing machine with mechanical stuffing of scoop openings. We made relative comparison in field of plants distribution in conditions of agricultural practise.

Key words: sugar beet, sowing, variability of plants spacing

Subject of measurements was quality assurance of sugar beet seeding by the help of plant spacing equality after seeding by seeders with air seeding mechanism Becker, Planter and Monopill S with mechanical mechanism (fig.1). Worthy results by cropping of sugar beet are related to rising of aligned and balanced crop stand, what could be achieved also by good quality of sowing. Paper is attended to quality of sowing in term of obtaining the most equal spacing of seeds in row. RYBÁČEK, (1985); KRETSCHMAR, (1988) ; SCHRÖDL (1998) ; PÁLTIK et al. (2000) etc. attends yourselves to presented enquiries in their publications.

METHODOLOGY

Provided experiments are connected with project VEGA number 1/7686/20 "Effectiveness of technical and technological innovations of the selected root and oil crops" planting solve in the department of machinery and production systems, Agricultural University in Nitra. Measurements were realized in field conditions according to ISO 7256/1 standard with characterization of soil conditions and properties of used seed. We had measured *variability of plants spacing* by representation of doubles, so-called required plants layouts, gapping omissions and accuracy of plants layout. The term *accuracy of plants layout* means the value of standard deviation of measured plants spacing from so-called effective plants spacing (ISO 7256/1). We had observed five construction solutions of drills by sowing of coated sugar beet seed with calibration of 3,5 - 4,75 mm diameter.

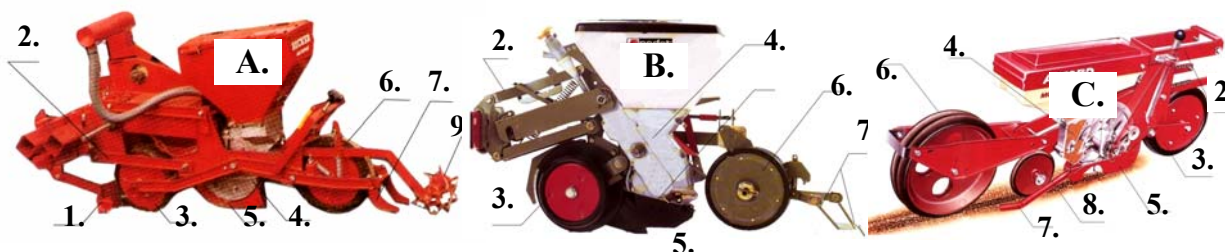


FIG. 1: PLANTERS: A. BECKER SE 4-049, B. PLANTER II, C. MONOPILL S: 1. SEEDING AREA CLEANER, 2. PARALELOGRAM, 3. FRONT PRESS WHEEL, 4. SEEDING MECHANISM, 5. SEEDING OPENER, 6. BACK PRESS WHEEL, 7. COVER, 8. MIDDLE NARROW PRESS WHEEL, 9. COMPOUDER OF SOIL

RESULTS AND DISCUSSION

Sugar beet sowing was done realized on sandy-loam soil with by weight content of clods to 10 mm - 77 % and to 40 mm - 100 %, so the soil was partially prepared. Properties of coated sugar beet seed used by tests of drills are listed in table1.

Tab. 1: Properties of coated seed with calibration 3,5-4,75 mm

Parameter	Unit	Abundance of seeds in dimension categories						
		3,5-4,75 mm	<3,5 mm	3,25-3,49 mm	<3,25 mm	>4,75 mm	4,75-4,99 mm	>4,99 mm
Required limits*	%	min.88	6	4,5	1,5	6	4,5	1,5
Real values	%	96,5	3,5	3,5	0	0	0	0

Note: * required values of abundance in individual categories, - Average length of seeds $l = 4,21$ mm, Average width of seeds $s = 3,93$ mm, Average thickness of seeds $h = 5,61$ mm, The weight of thousand seeds = 26,4 g

Tab.2: Percentage share/abundance of sugar beet speed in particular size type by calibration 3,5 – 4,75mm

Seed width *		Tolerance **		Seed Patrícia	
mm		%		%	
3,5-4,75		88		96,5	
<3,5		6		3,5	
3,25-3,49	<3,25	4,5	1,5	3,5	0
>4,75		6		0	
4,75-4,99	>4,99	4,5	1,5	0	0

* seed width in the second biggest parameter according to which is seed calibrated

** there is not exact ISO standard for determination of parameter attributes of seed, but there is possibility to use recommended share in particular size type presented in the tables as a tolerance

Variability of plants spacing has significant effect on quality of harvest operation, especially on quality of roots topping. It is given by properties of soil, used seed, but mainly by technical construction of sowing units and work speed of drills.

If we come out from assumption of equal soil conditions and identical seed (calibration 3,5 – 4,75 mm), then we are able to substantiate that eventual differences in variability of plants spacing are related to construction of drill as well as to their work speed.

Let us compare some of the measured drills. First of all, nowadays the most utilized drill in Slovakia - Becker SE 4-049 with pressure gauge pneumatic sowing mechanism, then Planter II of Kuhn-Nodet company with under pressure pneumatic sowing mechanism and Monopill S drill of Kverneland-Accord company with mechanic internal loading of seeds (table 3).

Tab. 3: Results of horizontal layout of plants by observed types of drills

Seed (calibration)	Machine	Work speed	Required (adjusted) spacing of plants	Effective spacing of plants (x ₂)	Standard deviation (x ₁)	Plants layout				
						Required plants layout (PRR)	Doubles (x ₃)	Single gaping omission (x ₄)	Double gaping omission	> than double gaping omission
mm		m.s ⁻¹	cm	cm	mm	%	%	%	%	%
(3,5-4,75)	Planter II	0,68	17,7	16,40	33,64	78,9	0,7	15,8	3,1	1,5
	Planter II	1,07	17,7	16,35	36,44	77,9	2,4	15,2	3,2	1,4
	Planter II	1,71	17,7	16,67	39,23	72,9	3,3	15,7	4,6	3,4
	Planter II	1,99	17,7	16,27	37,44	74,7	3,7	16,5	3,8	1,3
	Planter II	2,42	17,7	16,64	41,17	64,2	3,8	20,8	7,4	3,9
	Planter II	Mean		17,7	16,47	35,58	73,7	2,8	16,8	4,4
(3,5-4,75)	Becker	0,88	19,0	18,91	30,85	81,7	1,0	13,4	2,9	0,9
	Becker	1,26	19,0	19,06	35,33	77,4	0,9	17,5	3,1	1,2
	Becker	1,73	19,0	19,08	39,46	83,0	2,1	12,4	2,4	0,1
	Becker	2,06	19,0	18,87	43,21	78,3	2,9	15,4	3,1	0,4
	Becker	2,68	19,0	18,86	49,82	78,8	3,6	15,9	1,2	0,5
	Becker	Mean		19,0	18,96	39,73	79,8	2,1	14,9	2,5
(3,5-4,75)	Monopill S	0,68	17,7	17,83	22,78	75,9	0,8	16,3	5,9	1,0
	Monopill S	1,07	17,7	17,81	20,52	76,8	0,8	15,9	5,3	1,2
	Monopill S	1,71	17,7	17,82	20,29	76,7	0,9	15,3	3,9	3,1
	Monopill S	1,99	17,7	17,92	17,84	77,9	0,8	16,2	3,4	1,7
	Monopill S	2,43	17,7	17,92	20,28	73,8	0,9	19,5	3,7	2,0
	Monopill S	Mean		17,7	17,86	20,34	76,2	0,9	16,6	4,4

x₁ – statistic value characterizing sample variance of plants spacing towards to so-called effective plants spacing,

x₂ – effective plants spacing (EVR), it is calculated average mean of plants spacing (ISO 7256/1),

x₃ – doubles, where the spacing of plants is less than 0,5 of EVR,

x₄ – single gaping omissions, where the spacing of plants is more than 1,5 to 2,5 of EVR etc.

In term of *plants spacing variability*, the best results were obtained by drill Monopill S (with average value of standard deviation of plants spacing $\bar{s} = 20,34$ mm) and the worst one obtained drill Becker ($\bar{s} = 39,73$ mm).

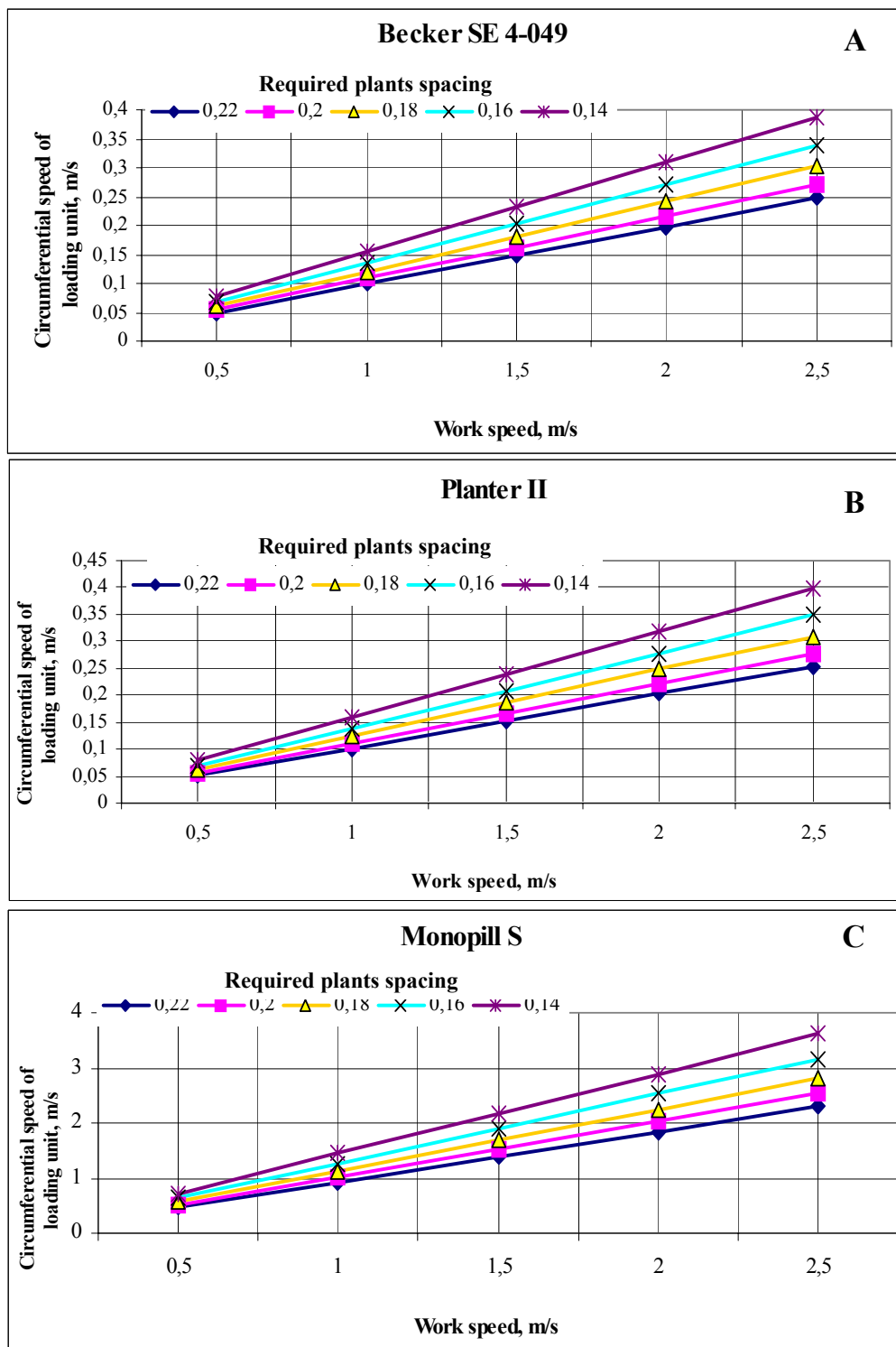


FIG. 2: DEPENDENCE OF DRILLS WORK SPEED ON CIRCUMFERENTIAL SPEED HORIZONTAL COMPONENT OF LOADING UNIT A. DRILL BECKER SE 4-049, B. DRILL PLANTER II, C. DRILL MONOPILL S

It is possible to reason the presented fact mainly by different speeds of seed fall from sowing unit to sowing furrow. Construction principle of Monopill S drill provides minimal nearly zero difference between work

speed of drill and horizontal component of loading unit circumferential speed in a moment of seed unloading (fig. 2C). The situation by Planter II (fig. 2B) and Becker (fig. 2A) drills is different. This fact causes increase of seed spacing sample variance.

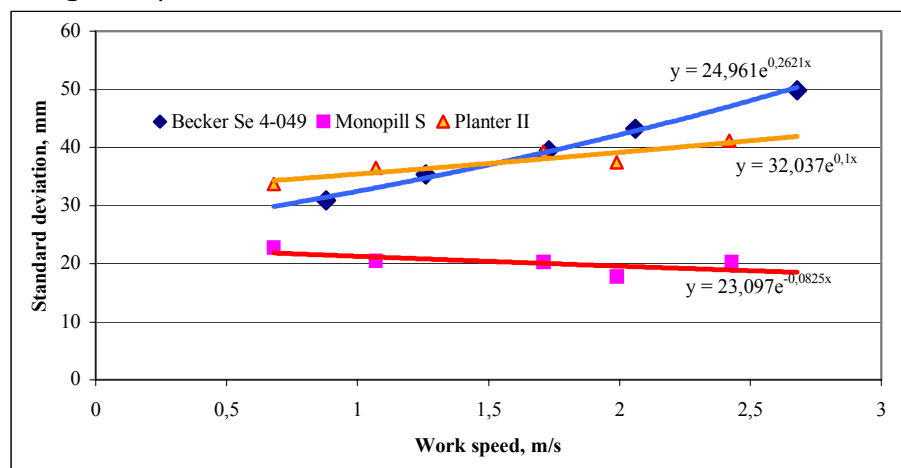


FIG. 3: RELATIVE COMPARISON OF PLANTS SPACING VARIABILITY CHANGE IN DEPENDENCE ON WORK SPEED

In term of *doubles* and *gaping omissions*, there are minimal differences between observed drills. It is evident that also the drill with mechanical filling of loading openings is able to meet required parameters by providing of well calibrated seed application. Relative comparison of plants variability change in dependence on work speed is presented in fig. 3.

CONCLUSION

- In term of plants spacing variability, the best results were obtained by drill Monopill S and generally we could say that other drills working with similar principle will also obtain the best results (Meca 2000, Unicorn 3 etc.).
- The optimal work speed for required seed spacing exists by drills with similar construction solution as Monopill S, when regular variability of plants spacing is obtained. This fact does not refer to Becker SE 4-049 and Planter II drills.

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Ing. Pavol FINDURA, DEPARTMENT OF MACHINES AND PRODUCTION SYSTEMS, FAE SUA in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, SLOVAKIA, tel: 037/6508478, fax: 037/7417003, e-mail: pavol.findura@uniag.sk