

ROW SPACING AND WEED CONTROL STUDY IN WINTER WHEAT



STUDY CONTACT:

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OBJECTIVE:

The objective of this study was to evaluate yield and operating costs in winter wheat grown with different row spacing, seed rates and weed control regimes, comprising standard and wide row spacing as well as herbicide-free and conventional chemical weed control.

STUDY DESIGN:

The study was carried out on the Swiss Future Farm in the field season 2021-2022 as a side-by-side strip trial. The trial plot was planted in an intensive tillage system after silage corn. Winter wheat was seeded on 20th October 2021 with a seed drill at either normal (12.5 cm) or wide (37.5 cm) row spacing and full (100%) or reduced seed rate (60%) with hybrid DSP Montalbano and grown with either chemical or mechanical weed control (Table 1, Figure 1). Except seeding and weed control, all field operations for seedbed preparation, fertilizer application (total 156 kg N/ha), and harvest were conducted uniformly across all trial strips.

Wide row spacing in combination with herbicide-reduced or herbicide-free weed control in cereals is a new biodiversity scheme in the Swiss Agricultural Policy to promote the endangered species of brown hare (*Lepus europaeus*) and field lark (*Alauda arvensis*) as well as to promote field flora. The grain field is sown in such a way that a striped pattern with at least 30 cm wide gaps in unsown areas is created. At least 40% of the rows must remain unsown distributed over the width of the drill; the distribution may vary. There are no specifications for the amount of seed in the sown rows, but a reduction in the amount compared to normal sowing is recommended. Normally, three sown rows are created followed by two unsown rows (closed outlets). Weeds may be controlled in the spring either by a single harrowing by April 15th or controlled by a single herbicide application. In fall, herbicide application and harrowing are allowed. Crop protection treatments with products in categories other than herbicides (e.g., fungicides) are allowed. Farmers applying this biodiversity scheme are compensated with additional direct payments of up to 500.00 CHF/ha.

Trial strip	Row Spacing and Weed Control	Field Operations
1	Normal (12.5 cm, 100% seed rate) + Herbicide	Seeding w/ seed drill at 350 seeds/m ² = 177 kg/ha (1x) Chemical weeding w/ tractor and sprayer (1x)
2	Normal (12.5 cm, 100% seed rate) + Mechanical	Seeding w/ seed drill at 350 seeds/m ² = 177 kg/ha (1x) Mechanical weeding w/ tine harrow (1x)
3	Wide (37.5 cm, 60% seed rate) + Herbicide	Seeding w/ seed drill at 200 seeds/m ² = 101 kg/ha (1x) Chemical weeding w/ sprayer (1x)
4	Wide (37.5 cm, 60% seed rate) + Mechanical	Seeding w/ seed drill at 200 seeds/m ² = 101 kg/ha (1x) Mechanical weeding w/ tine harrow (1x)

Table 1. Row spacing and weed control treatments tested for the SFF 2022 Row Spacing & Weed Control Study in winter wheat.

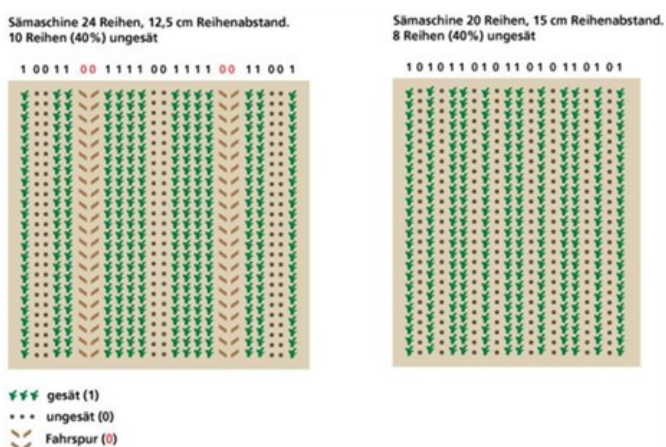


Figure 1. Seeding patterns for wide row spacing and 40% reduction of seed rate (left), winter wheat with wide row spacing after emergence in fall (right) on the trial plot of the SFF 2022 Row Spacing and Weed Control Study in Winter Wheat.

RESULTS:

The trial was harvested on 25th July 2022. The highest yield was achieved in winter wheat grown with normal row spacing and chemical weed control (7.3 t/ha), whereas with normal row spacing and mechanical weed control a yield reduction of 5.5% was found. Wide row spacing with chemical weed control yielded 24.7% less grain, and wide row spacing and mechanical weed control showed a yield reduction by 32.9% compared to winter wheat grown with normal row spacing and chemical weed control (Figure 2). Thus, both methods with wide row spacing partially compensated for the reduced seed rate.

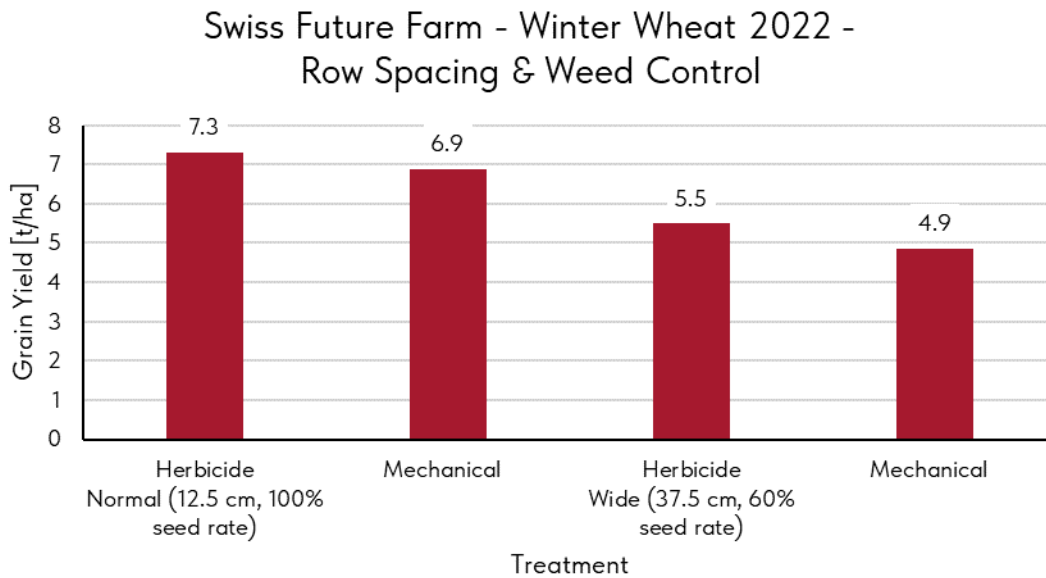


Figure 2. Grain yield results of the SFF 2022 Row Spacing and Weed Control Study in winter wheat.

Highest hectoliter weight was obtained for grain harvested from the trial strip with normal row spacing and mechanical weed control, whereas all other row spacing and weed control treatments were on an equivalent, slightly lower level, hence a clear correlation cannot be identified (Figure 3).

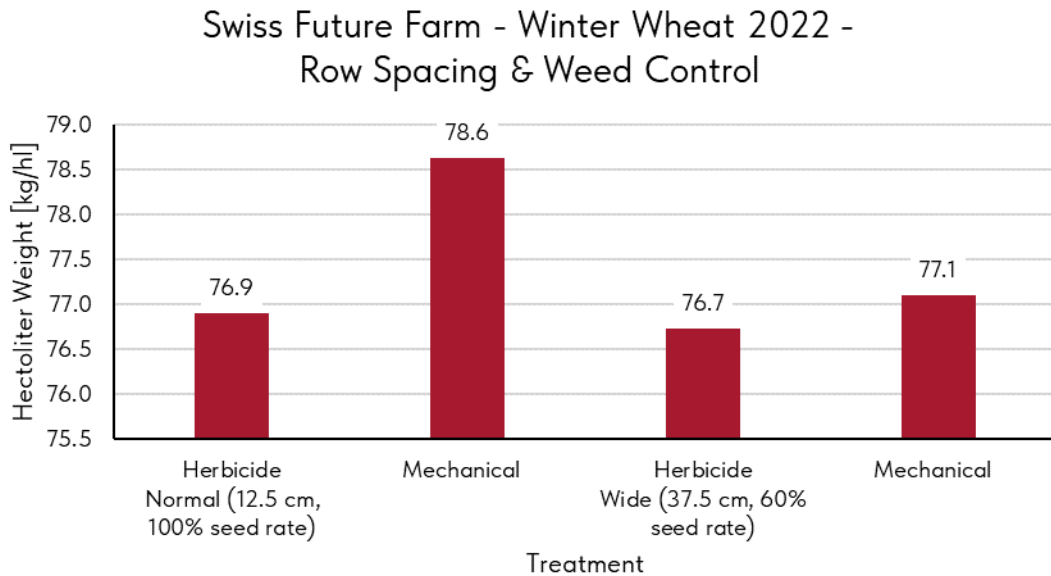


Figure 3. Hectoliter weight results of the SFF 2022 Row Spacing and Weed Control Study in winter wheat.

Protein content was significantly higher for winter wheat grown with wide row spacing, both under chemical and mechanical weed control (Figure 3). This may be due to lower grain yield in these trial strips, which facilitates wheat plants to generate higher protein contents.

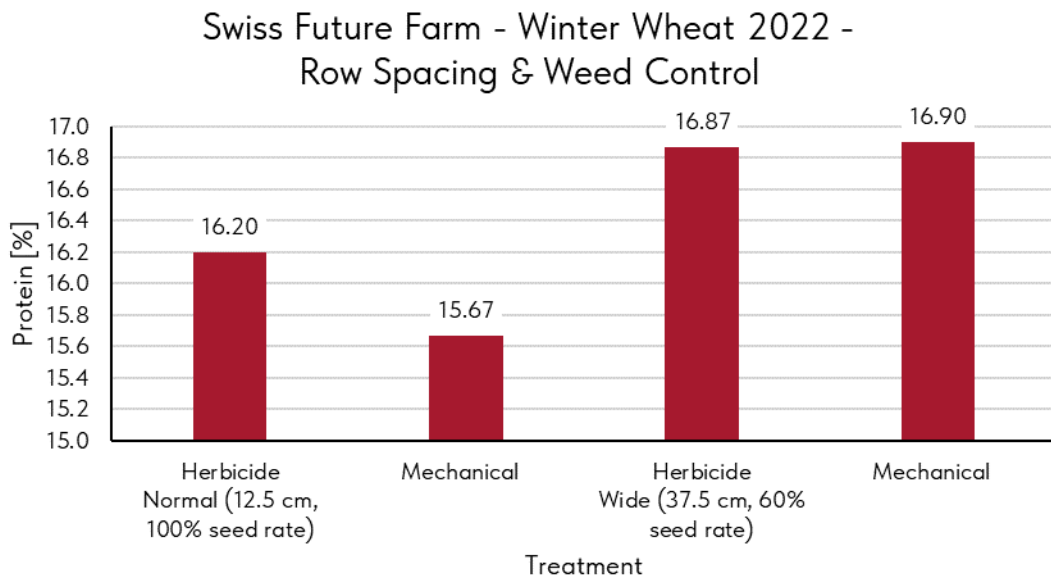


Figure 4. Protein content results of the SFF 2022 Row Spacing and Weed Control Study in winter wheat.

Table 2 shows the results on revenue, operating costs, production costs per ton of grain, and contribution margin 2 for winter wheat grown with different row spacing and weed control methods. Operating costs comprise machinery, input, and labor costs for all field operations along the crop cycle from pre-planting fertilization, tillage and seedbed preparation, seeding, crop care to harvest. Except seeding and weed control, all field operations were conducted uniformly across all trial strips. Highest operating costs resulted for the Normal Row Spacing + Herbicide treatment, nonetheless, due to the higher yield and income, this treatment delivered the highest contribution margin in the comparison (Table 2). Although operating costs were lower for all other treatments, this did not compensate for the yield reduction obtained either with mechanical weed control or wide row spacing.

	Normal (12.5 cm, 100% seed rate) + Herbicide	Normal (12.5 cm, 100% seed rate) + Mechanical	Wide (37.5 cm, 60% seed rate) + Herbicide	Wide (37.5 cm, 60% seed rate) + Mechanical
Grain Yield (t/ha)	7.3	6.9	5.5	4.9
Hectoliter Weight (kg/hl)	76.9	78.6	76.7	77.1
Protein (%)	16.20	15.67	16.87	16.90
Deliverables (CHF/ha)				
Crop Value / Revenue	4302.15	4037.90	3228.20	2852.50
Costs (CHF/ha)				
Tillage	250.92	250.92	250.92	250.92
Seeding	333.05	333.05	227.49	227.49
Fertilization	1159.49	1159.49	1159.49	1159.49
Herbicide Application	143.76	0.00	143.76	0.00
Insecticide Application	0.00	0.00	0.00	0.00
Fungicide Application	0.00	0.00	0.00	0.00
Mechanical Weeding	0.00	38.93	0.00	38.93
Harvest	549.86	549.86	549.86	549.86
Labor	222.93	225.66	222.93	225.66
Outcomes				
Operating Costs (CHF/ha) incl. machine, labor, inputs costs	2660.02	2557.91	2554.45	2452.35
Production Costs (CHF/t win- ter wheat)	363.56	327.48	465.28	505.51
Contribution margin 2 (CHF/ ha) incl. machine, labor, in- puts costs	1642.13	1479.99	673.75	400.15
Contribution margin 2 (CHF/ ha) incl. machine, labor, in- puts costs and biodiversity subsidies (hare or skylark)	1642.13 (no subsidies)	1479.99 (no subsidies)	973.75	900.15

Figure 4 shows a graphical comparison for revenue, operating costs, and production costs per ton of winter wheat as results of this study.

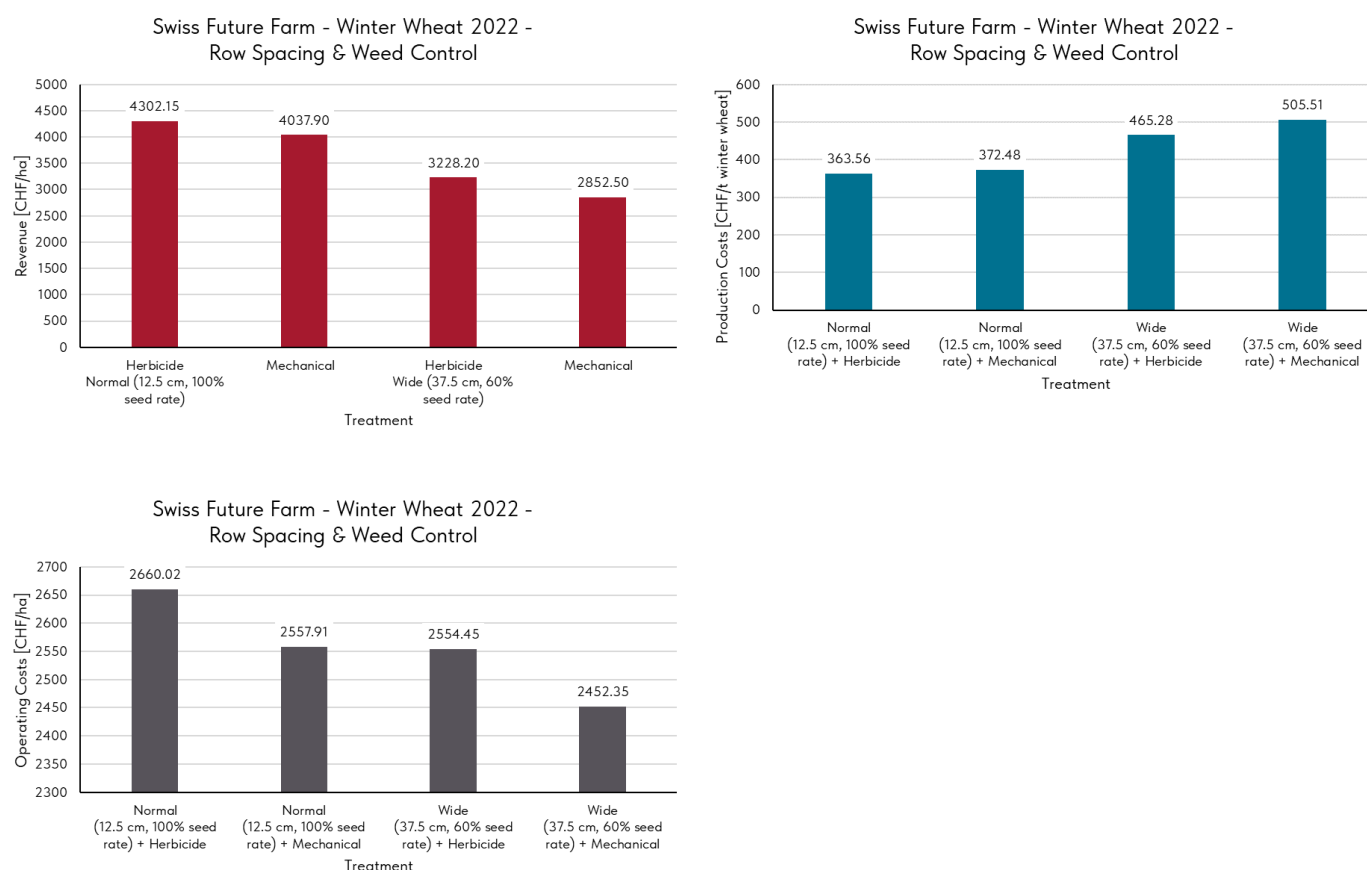


Figure 5. Revenue, operating costs, and production costs per ton of winter wheat for the SFF 2022 Row Spacing and Weed Control Study in winter wheat.

FINANCIAL:

Ear count results in BBCH stage 50-60 show that the targeted amount of 600 ears per square meter in winter wheat was only achieved in the Normal Row Spacing treatment (Figure 6). This observation is in line with the results on grain yield, where normal row spacing and full seed rate provided significantly higher yield than wide row spacing, independent of the weed control method applied. Nevertheless, it should be noted that the Wide Row Spacing plots with only 60% less seed rate resulted in only a 22% spike reduction (with chemical weed control) and 26% spike reduction (with mechanical weed control). Therefore, the wheat plants sown in Wide Row Spacing showed more tillering.

Swiss Future Farm - Winter Wheat 2022 - Row Spacing & Weed Control

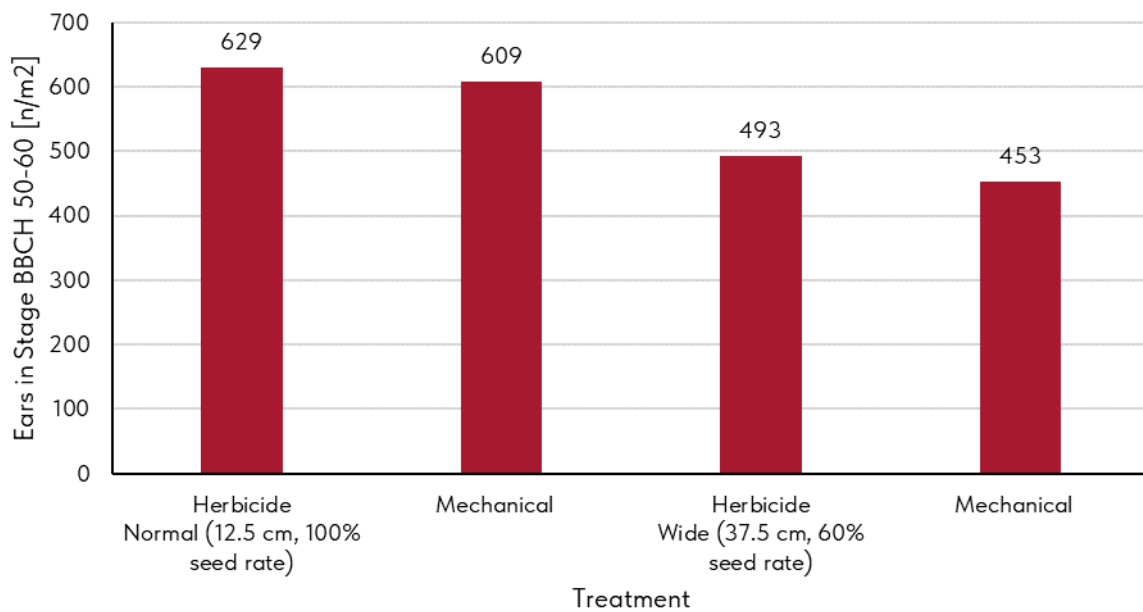


Figure 6. Ear count results of the SFF 2022 Row Spacing and Weed Control Study in winter wheat.

CONCLUSIONS:

- Fendt VarioGuide with RTK ensures planter passes with maximum accuracy and operator comfort and enables to use identical waylines for weed control operations.
- Fendt Contour Assistant enables optimum wayline adaption to the contours of the field during planting.