Research paper

The Growth and Biomass Yield of Common Buckwheat (*Fagopyrum esculentum* (L.) Moench) Under Different Crop Management Systems

Sunday Ebonka NWAJEI*, Jana PEXOVÁ KALINOVÁ

Department of Plant Production, Faculty of Agriculture and Technology, University of South Bohemia, Studentská 1668, 370 05 České Budějovice, Czech Republic, nwajes00@jcu.cz, janak@fzt.jcu.cz

* Corresponding author: *nwajes00@jcu.cz*

DOI https://doi.org/10.3986/fag0051

Received: September 29, 2025; accepted December 10, 2025

Keywords: Common buckwheat, crop management, system, growth, biomass, yield.

ABSTRACT

Growing crops as cover or companion crops, as well as for green manure, forms the basis of sustainable and organic field crop production. This practice helps reduce soil degradation and supports sustainable soil management. The aim of this field study was to evaluate the effects of crop management systems on the growth and biomass yield of two varieties of common buckwheat. The crop management systems tested were: common buckwheat (Zoe and Harpe) grown alone (control), intercropped with sorghum (*Sorghum bicolor*), intercropped with a mixture of lacy phacelia (*Phacelia tanacetifolia*) and white mustard (*Sinapis alba*), and grown in postharvest wheat residues (straw). The experiment was laid out in a randomized complete block design with three replicates. Data were collected on plant height (cm), number of leaves/plant, number of branches/plant, total leaf area/plant (cm^2), stem diameter (cm), and biomass yield (t/ha). Crop management systems had a significant effect on the number of branches/plant, stem diameter, and overall biomass yield of buckwheat. The highest biomass yield (1.13 t/ha dry weight) was obtained from Harpe variety intercropped with *Phacelia* + *Sinapis*, while the lowest value 0.71 t/ha was recorded in the control. Given the high biomass yields, intercropping common buckwheat with *Phacelia* + *Sinapis* mixtures is a promising option for green manure production. Although the buckwheat varieties differed in number of leaves, leaf area, and number of branches/plant, the variety used did not have a statistically significant effect on biomass yield.

INTRODUCTION

Common buckwheat (*Fagopyrum esculentum* Moench) is a fast-growing crop in the knotweed family Polygonaceae cultivated primarily for its achenes, but also as a cover crop or intercrop for sustainable crop production (Falquet et al. 2015). In soil, buckwheat enhances organic carbon, nutrient cycling and microbial activities, reduces erosion by mitigating raindrop impact and run off, and contributes to moisture conservation (Kato-Noguchi et al. 2007; Glaze-Corcoran et al., 2020). Additionally, buckwheat exhibits the ability to suppress weeds through root allelopathy and the specific leaf arrangemet (Woźniak et al., 2025), provides effective soil protection and supports insect pollinators during flowering (Liszewski & Chorbiński, 2021).

A crop management system is a logical combination of agricultural practices orderly or operations applied to a field in order to obtain a desired level of crop production (Sun et al., 2018; Maitra et al., 2021). It also consists of a mixture of crops of different species grown in the same field, to achieve more sustainable and profitable crop cultivation (Maitra et al., 2019; Ren et al., 2019). A crop management system encompasses the strategies used by farmers to grow, maintain and harvest crops in a given agroecosystem (Gao et al., 2024). The system focuses on beneficial interactions, efficient resource use, and controlling pests, weeds, and diseases to maximize yield (Woźniak et al., 2025). Sustainable management strategies aim to improve soil fertility, water use, and plant protection by leveraging the synergistic effects between crops (Chen et al., 2019; Lin et al. 2019). Crop management strategies may differ in how they balance plant responses, competition, complementary, and functional diversity (Akhtar et al., 2018).

Intercropping utilizes complementary interactions between species, and crop mixtures promote increased vegetative growth and higher biomass yields (Qu et al., 2023; Groß et al., 2024). Intercropping and cover crops can significantly influence plant growth, therefore farmers should consider appropriate intercropping strategies, planting geometry, and plant protection measures to achieve desired yield (Maitra et al., 2019; Moreira et al., 2024). Mulching modifies the soil microenvironment and support plant growth, while crop mixtures use functional diversity to maintain biomass production and enhance ecosystem benefits (Zhang et al., 2011; Lin et al., 2019).

While monoculture provides a baseline, it often lacks resource efficiency and ecological benefits (Feng et al., 2021; Gao et al., 2024) High-input systems, such as uncontrolled usage of mineral fertilizers and pesticides, often result in higher biomass production but can have negative environmental consequences (Sun et al., 2018; Basaran, et al., 2020). Crop management practices that enhance soil health and nutrient cycling, thereby increasing biomass production and resource use efficiency should be prioritized.

By comparing crop management systems in buckwheat production, their roles can be better understood — not only in terms of yield, but also in relation to green manuring and cover cropping for agricultural sustainability. Therefore, this study aims to evaluate the effects of different crop management systems on the vegetative growth and biomass yield of two varieties of common buckwheat (*F. esculentum*).

MATERIALS AND METHODS

Experimental location and design

The field study with common buckwheat was carried out at the Teaching and Research Farm, Faculty of Agriculture and Technology, University of South Bohemia, České Budejovice (48°58'43.15"N and 14°26'54.3"E, 380 m elevation, sandy–loam soil, pH 5.6, average annual temperature 9.7°C, average annual total precipitation 808 mm) during the 2024 cropping season.

The experiment was a 2 × 4 factorial scheme fitted into a Randomized Complete Block Design. The crop management systems tested were: two varieties of common buckwheat (Zoe and Harpe) grown alone (control), intercropped with sorghum (*Sorghum bicolor,* Ruzrok variety), intercropped with a mixture of lacy phacelia (*Phacelia tanacetifolia, Fiona* variety) and white mustard (*Sinapis alba, Sněženka* variety) and grown in postharvest wheat residues (straw) with the 8 treatment combinations replicated three times to give a total of 24 plots.

Seeds of the 2 varieties of buckwheat were sown in rows at a spacing of 25cm while sorghum and *Phacelia* + *Sinapis* were sown between rows of buckwheat at a spacing of 12.5cm by a precision seed drill. A total population of 200 plants/m2 was involved for buckwheat planted alone (control) and 100 plants/m^2 each for both buckwheat in intercrop with sorghum treatment as well as in mixtures with *Phacelia* + *Sinapis* treatment. The individual testing plot size of 1.25 × 4m was measured with 1m within plots and between replicates. Planting took place on 23rd June, 2024. At 4 weeks after planting (at flowering stage) data were collected.

Vegetative growth parameters

In each plot, a total of ten plants from two middle rows per plot were randomly tagged for data collection. The parameters measured were:

Plant height (cm) was taken with a measuring tape from the soil surface to the apex of the crop where the youngest leaf branches.

Number of leaves per plant and ***number of branches per plant*** were visually counted.

Total leaf area per plant (cm^2) was measured from leaves at the middle canopy (fifth fully expanded leaf) using Petiole Pro plant leaf area meter app (Breskinaa & Chuyana, 2021) and the value was multiplied by total number of leaves/plant.

Stem diameter (cm) was obtained using a digital vernier caliper (at 2 cm) above the ground level.

Biomass yield (t/ha) was determined by harvesting the whole plant at 2 cm above the ground level and weighed. The forage yield was calculated using the formula described by Nwajei et al. (2019), as stated below:

$$\text{Forage yield (t/ha)} = \frac{\textit{Fresh}\text{ weight (g)}}{\text{Harvested plot area (m}^2\text{)}} \times \frac{10000\ (\text{m}^2)}{1000}\ \frac{1}{1000}$$

The dry matter weight of the harvested ten plants per plot was determined by oven–drying the plants at 70°C to a constant weight according to Saifullah et al. (2011) and the values were calculated to t/ha using the same formula as used for forage yield.

The dry matter % was calculated using the formula described by Saifullah et al. (2011) as shown below:

$$\%\ \textit{Dry Matter} = \frac{\textit{dry weight}}{\textit{fresh weight}} \times \frac{100}{1}$$

Statistical analysis

All data obtained were analyzed using analysis of Variance (ANOVA) with GenStat 12th edition software program (GenStat, 2009). Means were compared using Duncan's Multiple Range Test (DMRT) at 5% level of probability.

RESULTS

Plant height

The tallest plants were recorded by the buckwheat grown with straw residues while the sole buckwheat plants were the shortest (Table 1). Zoe variety was taller than Harpe. However, the variety as well as the different crop management systems did not significantly influence the plant height of buckwheat. The variety and crop management system interaction affected the height of buckwheat significantly. Plants of Zoe variety mulched with straw had the highest plant height (49.24cm), while the plants of sole Harpe variety had the lowest height (32.85cm).

Number of leaves

The mean number of leaves per plant varied from 8.17–8.60 in Zoe and 7.17 to 8.57 in Harpe variety (Table 1). Zoe mulched with straw had the highest number of leaves per plant (8.60), while Harpe in monoculture had the lowest (7.17). The varieties sowed and their interaction with the crop management system significantly affected the number of leaves per plant of buckwheat. Although Zoe had generally a higher number of leaves/plants than Harpe, both varieties had similar values, approximately 8 leaves per plant. Similarly the plants inrcroped with *Phacelia* + *Sinapis,* which had the highest number of leaves/plant, showed valuees close to 8 leaves, compareble to other treatments.

Number of branches

The number of branches per plant of two common buckwheat varieties was significantly influenced by the varieties, crop management systems and variety × crop management system interaction (Table 1). The number of branches per plant ranged from 4.23 – 4.87 and 2.93 – 4.40 in Zoe and Harpe. Overall, Zoe + sorghum intercrop had the highest number of branches/plant (4.87) while sole Harpe had the lowest (2.93). Generally, the plants intercropped with sorghum, which had the highest values, produced a similar number of branches per plant, approximately 5, to those grown in the mixture with *Phacelia* + *Sinapis*. Zoe had the higher (4.51) average number of branches/plant than Harpe (3.71).

Table 1. *Effect of crop management system on the growth of two varieties of common buckwheat*

Treatment	Plant height (cm)	Number of leaves/ plant	Number of branches/ plant	Total leaf area (cm^2)	Stem diameter (cm)
Variety (V)					
ZOE	45.86	8.32a	4.51a	7490.70a	0.61
HARPE	37.64	7.83b	3.71b	6141.99b	0.58
Crop management system (CMS)					
Sole	39.53	7.75	3.58b	7175.91a	0.54b
Intercrop with Sorghum	42.14	8.03	4.63a	7496.81a	0.64a
Mulched with straws	43.57	8.15	3.75b	7508.69a	0.56b
Mixture with *Phacelia* + *Sinapis*	41.77	8.37	4.47a	5083.96b	0.64a
Interaction (V x CMS)					
Sole Zoe	46.20ab	8.33a	4.23a	8399.87a	0.56c
Zoe + Sorghum	43.87ac	8.17ab	4.87a	7457.47ab	0.60ac
Zoe + Straw	49.24a	8.60a	4.23a	8455.62a	0.57bc
Zoe + *Phacelia* + *Sinapis*	44.13ac	8.17ab	4.70a	5649.83bc	0.60ac
Sole Harpe	32.85d	7.17b	2.93b	5951.95bc	0.52c
Harpe + Sorghum	40.42bc	7.90ab	4.40a	7536.16ab	0.68a
Harpe + Straw	37.90cd	7.70ab	3.27b	6561.77ab	0.56c
Harpe + *Phacelia* + *Sinapis*	39.41bd	8.57a	4.23a	4518.09 c	0.67ab
SL					
V	1.52ns	0.23*	0.44*	426.95*	0.05ns
CMS	2.16ns	0.32ns	0.62*	603.60*	0.07*
V x CMS	3.05*	0.46*	0.87*	853.90*	0.09*

Values with same letter(s) in columns for: V. Variety, CMS. Crop management system and V×CMS. Interaction, are not significantly different using Duncans' multiple range test at 5% level of probability. SL: Significant level; ns: not significant.

Total leaf area

The crop management system, variety, and their interaction significantly affected the total leaf area produced by the buckwheat (Table 1). The total leaf area varied from 5649.83–8455.62 cm^2 in Zoe and 4518.09 –7536.16 cm^2 in Harpe. In total, the highest leaf area of buckwheat was recorded in Zoe grown with straw residues (8455.62 cm^2), while the lowest was observed in the Harpe + mixture (4518.09 cm^2). Plants mulched with straw and those in mixture with *Phacelia* + *Sinapis* showed the highest and lowest total leaf area/plant. Zoe had a higher total leaf area than Harpe.

Stem diameter

The crop management system had a significant effect on the stem diameter of both common buckwheat varieties (Table 1). The effect of variety on the stem diameter was not significant. There was also a significant ($P \leq 0.05$) interaction between variety and crop management system.

The highest stem diameter was recorded in the Harpe + sorghum treatment (0.68 cm), while the lowest was observed in sole Harpe (0.52 cm) (Table 1). On average, Zoe had a larger stem diameter than Harpe. Across the different crop management systems, the stem diameter of the plants was approximately 1 cm.

Yield

Plants harvested from the mixtures with *Phacelia* + *Sinapis* produced the highest forage yield of buckwheat, while those mulched with straw had the lowest. It was also observed that Zoe produced a higher forage yield (4.42 t/ha) than Harpe (4.20 t/ha). The highest (5.52 t/ha) was obtained from Harpe intercropped with *Phace-*

lia + *Sinapis*, while the lowest (2.75 t/ha) was recorded in sole-cropped Harpe.

The total dry matter yield varied significantly from 0.86 to1.05 t/ha in Zoe and 0.79–1.13 t/ha in Harpe. However, Zoe had a slightly higher (0.97 t/ha) average dry matter yield compared to Harpe (0.94 t/ha). The highest and lowest dry matter yields were recorded in Harpe intercropped with *Phacelia* + *Sinapis* (1.13 t/ha) and in the sole-cropped Harpe control (0.71 t/ha), respectively.

The results also showed that crops mulched with straw had a significantly higher dry matter percentage, while those intercropped with *Phacelia* + *Sinapis* had the lowest. The dry matter percentage ranged from 20.38% to 25.58% in Zoe and from 20.49% to 27.65% in Harpe. Although Harpe had a higher dry matter percentage overall, the difference between the two varieties was not statistically significant. The highest dry matter percentage (27.65%) was observed in sole-cropped Harpe, while the lowest (20.38%) was recorded in Zoe intercropped with *Phacelia* + *Sinapis*.

DISCUSSION

Effect of crop management system on the plant height of two varieties of common buckwheat

Plant height is an important component of vegetative parameter which serves as a key indicator of a plant's growth status, health, and genetic potential. It is a crucial parameter in agriculture for predicting crop yield, biomass, and susceptibility to lodging. In this study, crop management systems as mulching promoted the growth of taller plants in both common buckwheat varieties compared to monoculture. This may be due the fact that crop management system influence buckwheat growth through effect on resource availability by improving water and nutrient accessibility. Virili et al. (2024) report-

Table 2. *Effect of crop management system on the forage and dry matter yield of two varieties of buckwheat*

Treatment	Forage yield (t/ha)	Dry matter yield (t/ha)	Dry matter %
Variety (V)			
ZOE	4.42	0.97	22.69
HARPE	4.20	0.94	23.72
Crop management system (CMS)			
Sole	3.85bc	0.83c	24.46ab
Intercrop with Sorghum	4.73ab	0.88bc	22.14ab
Mulched with straws	3.29c	1.02ab	25.78a
Mixture with *Phacelia* + *Sinapis*	5.37a	1.09a	20.43b
Interaction (V x CMS)			
Sole Zoe	4.96ab	1.05ab	21.27ab
Zoe + Sorghum	4.05ac	0.92ac	23.52ab
Zoe + Straw	3.46bc	0.86bc	25.58ab
Zoe + *Phacelia* + *Sinapis*	5.22a	1.05ab	20.38b
Sole Harpe	2.75c	0.71c	27.65a
Harpe + Sorghum	5.40a	1.12a	20.77b
Harpe + Straw	3.12c	0.79c	25.99ab
Harpe + *Phacelia* + *Sinapis*	5.52a	1.13a	20.49b
SL			
V	0.37ns	0.05ns	1.43ns
CMS	0.53*	0.07*	2.02*
V x CMS	0.74*	0.11*	2.86*

Values with same letter(s) in columns for: V. Variety, CMS. Crop management system and V x CMS. Interaction, are not significantly different using Duncans' multiple range test at 5% level of probability. SL: Significant level; ns: not significant ed that buckwheat in mixtures produced highest plant heights and differed significantly from those in monocultures which agreed with the result of the present study.

Effect of crop management system on the number of leaves/plant of common buckwheat

The number of fully expanded leaves produce by a single plant reflects the plant's developmental stage and their ability to capture light for photosynthesis and production of assimilates. In this study, crop management systems interacted significantly with the varieties. However, the mixture of Harpe with *Phacelia* + *Sinapis* encouraged more leaves per plant than other treatments. This may be due to unterspecific competition within the mixture, which could have stimulated leaf development as a response to shading. Similarly, Heuermann et al. (2019); Groß et al. (2024) reported that crop mixtures interactions among species can promote plant growth.

Effect of crop management system on the number of branches/plant of common buckwheat

Branches are stem-like structures that grow from the main stem of a plant and contribute to canopy expansion and biomass production. Intercropping systems appeared to promote branching in buckwheat, potentially as a strategy to fill canopy gaps and compensate for shading, especially under taller intercrop partners like sorghum. Overall, intercropping buckwheat with sorghum or with *Phacelia* + *Sinapis* promoted a higher number of branches per plant compared to monoculture. This suggests that intercropping may stimulate lateral growth in response to light competition. Wortman et al. (2012); Couëdel et al. (2018) reported similar findings, suggesting that competitive species in intercrops may benefit from complementary interactions. Gao et al. (2024) also observed increased vegetative branching in buckwheat intercropped with alfalfa compared to monoculture.

Effect of crop management system on the total leaf area/plant of common buckwheat

Total leaf area is a critical determinant of photosynthetic capacity and biomass accumulation (Chen et al., 2019; Nwajei et al., 2019). In this study, buckwheat mulched with straw had the highest total leaf area, likely due to enhanced soil moisture retention, temperature regulation, and nutrient availability. These findings are consistent with those of Qu and Feng (2022), who reported that straw mulching increased leaf area in cereals and pseudocereals by conserving soil moisture and stabilizing soil temperature.

Effect of crop management system on the stem diameter of common buckwheat

Stem diameter is a measure of stem thickness which indicate plants strength mechanism, ability to absorb water and nutrients and allocation of assimilate to their structural tissues. Buckwheat plants intercropped with sorghum or with *Phacelia* + *Sinapis* developed thicker stems compared to those grown in monoculture or under straw mulch. This may be due to the fact, that thicker stems are associated with the ability to withstand or resist lodging conditions, higher nutrient uptake and greater support for plant development. These results align with the findings of Woźniak et al. (2025), who reported increased stem diameter in intercropped buckwheat compared to monoculture. Similar results were also observed by Basaran et al. (2020) in alfalfa–intercrop with an annual companion crop, supporting the findings of the present study.

Effect of crop management system on the biomass yield of common buckwheat

The forage yield is the weight of the above ground plant part taken at a specific stage of growth (Mariotti et al., 2016). It also includes water content, structural tissues and assimilates which are needed for animal feeding, soil cover, and short-term biomass supply. The dry biomass yield on the order hand is the oven dried weight of the above ground plant parts representing the structural tissues and biomass accumulated by crops after water have been removed (Omoregie et al., 2020).

In this study, intercropping systems involving sorghum, *Phacelia* + *Sinapis*, and straw mulch significantly improved forage and dry matter yields compared to monoculture. The mixture of buckwheat with *Phacelia* + *Sinapis* in particular provided canopy closure, which is beneficial for weed suppression and pollinator habitat provision. These results are in agreement with those of Virili et al. (2024), who reported significantly higher buckwheat biomass yields in crop mixtures compared to monocultures.

CONCLUSION

Crop management systems had a statistically significant effect on the number of branches/plant, total leaf area, stem diameter, and biomass yield of buckwheat with the intercrops and the mixtures being more favourable than other treatment and the control.

The effect of the crop management system—particularly the mixture with *Phacelia* + *Sinapis* and intercropping with sorghum—resulted in higher growth and biomass yield of buckwheat compared to monoculture and treatments mulched with wheat straw.

The mixture of Harpe + *Phacelia* + *Sinapis* produced the highest fresh (5.52 t/ha) and dry matter (1.13 t/ha) yields, while the control (monoculture) recorded the lowest values - 2.75 t/ha and 0.71 t/ha, respectively. Given these high biomass yields, intercropping common buckwheat with lacy phacelia and white mustard is a promising option for green manure production. Although the buckwheat varieties differed in vegetative traits such as number of leaves, total leaf area, and number of branches per plant, the variety used did not have a statistically significant effect on biomass yield.

Sorghum as a companion crop synergistically improved the overall biomass yield of buckwheat. This underscores the value of diversified crop management systems—particularly intercropping—for enhancing buckwheat's potential use in organic manuring and cover cropping.

ACKNOWLEDGMENTS

This work was supported by the project GAJU (Grant Agency of the University of South Bohemia in *České* Budějovice) No.96/2025/Z.

REFERENCES

Akhtar, K., Wang, W., Ren, G. & Khan, A. (2018). Changes in soil enzymes, soil properties, and maize crop productivity under wheat straw mulching in Guangzhou, China, *Soil Tillage and Research* 182, 94–102. https://doi.org/10.17557/tjfc.831941.

Basaran, U., Gulumser, E., Copur, M. & Mut, H. (2020). Improving yield and quality in spring-sown alfalfa with annual companion crops. *Turkey Journal of Field Crops* 25, 138–146. https://doi.org/10.17557/tjfc.831941.

Chen, Y., Chai, S., Tian, H., Chai, Y., Li, Y., Chang, L. & Cheng, H. (2019). Straw strips mulch on furrows improves water use efficiency and yield of potato in a rainfed semiarid area. *Agricultural Water Management* 211, 142–151. https://doi.org/10.1016/j.agwat.2018.09.048

Couëdel, A., Alletto, L., Tribouillois, H. & Justes, É. (2018). Cover crop crucifer legume mixtures provide effective nitrate catch crop and nitrogen green manure ecosystem services. *Agriculture Ecosystem and Environment* 254, 50–59. https://doi.org/10.1016/j.agee.2017.11.017.

Falquet, B., Gfeller, A., Pourcelot, M., Tschuy, F., Wirth, J. (2015). Weed Suppression by Common Buckwheat: A Review. *Environment Control in Biology* 53, 1–6. DOI:10.2525/ecb.53.

Feng, C., Sun, Z., Zhang, L., Feng, L., Zheng, J., Bai, W., Gu, C., Wang, Q., Xu, Z., Van Der Werf, W. (2021). Maize/peanut intercropping increases land productivity: A meta-analysis. *Field Crops Research* 270, 1–8. DOI: 10.1016/j.fcr.2021.108208.

Gao, J., Xu, W., Xi, W., Huang, R., Zhao, Z., Xie, H. & Zhang, F. (2024). Oats Intercropping and Biochar Amendment Modify Soil Nutrients and Microbiota Structure to Enhance the Quality of Continuous Cropping Peppers. *Journal of American Society for Horticultural Science* 59, 1396 – 1406. DOI: 10.21273/hortsci17882-24.

GenStat (2009). GenStat for windows (12th ed.), VSN International. Retrieved from https://www.vsni.co.uk

Glaze-Corcoran, S., Hashemi, M., Sadeghpour, A., Jahanzad, E., Keshavarz Afshar, R., Liu, X. & Herbert, S.J. (2020). Understanding Intercropping to Improve Agricultural Resiliency and Environmental Sustainability. *Advanced Agronomy* 162, 199-256 DOI: 10.1016/bs.agron.2020.02.004.

Groß, J., Kümmerer, R., Heuermann, D., Gentsch, N., Schweneker, D., Feuerstein, U., Guggenberger, G., Von Wire, N. & Bauer, B. (2024). Improving dual cover crop mixtures to increase shoot biomass production and weed suppression potential. *Frontier in Agronomy* 6, 1-17. https://doi.org/10.3389/fagro.2024.1416379

Heuermann, D., Gentsch, N., Boy, J., Schweneker, D., Feuerstein, U., Groß, J., Bauer, B., Guggenberger, G. & VonWirén, N. (2019). Interspecific competition among catch crops modifies vertical root biomass distribution and nitrate scavenging in soils. *Scientific Report* 9, 1-11. DOI: 10.1038/s41598-019-48060-0

Kato-Noguchi, H, Sugimoto, H. & Yamada, M. (2007). Buckwheat seedlings may inhibit other plant growth by allelopathic substances. *Environment Control in Biology* 45, 27–32. DOI:10.2525/ecb.45.27.

Lin, F., Liu, X.J., Tong, C.C. & Wu, Y. (2019). Effects of intercropping on light energy utilization characteristics and productivity of different feed crops. *Chinese Journal of Ecology* 30, 3452–3462. DOI: 10.13287/j.1001-9332.201910.006.

Liszewski, M. & Chorbiński, P. (2021). The influence of foliar buckwheat fertilization with copper, manganese, and iron on selected parameters of its nectar production and seed yield. *Polish Journal of Agronomy* 46, 23–30. DOI: 10.26114/pja.iung.467.2021.46

Maitra, S., Palai, J.B., Manasa, P. & Kumar, D.P. (2019). Potential of intercropping system in sustaining crop productivity. *International Journal of Agriculture, Environment and Biotechnology* 12, 39–45. DOI: 10.30954/0974-1712.03.2019.7

Maitra, S., Hossain, A., Brestic, M., Skalicky, M., Ondrisik, P., Gitari, H., Brahmachari, K., Shankar, T., Bhadra, P., Palai, J. B., Jena, J., Bhattacharya, U., Duvvada, S. K., Lalichetti, S. & Sairam, M. (2021). Intercropping—A Low Input Agricultural Strategy for Food and Environmental Security. *Agronomy*, 11, 343–371. https://doi.org/10.3390/agronomy11020343.

Mariotti, M., Masoni, A. & Arduini, I. (2016). Forage and grain yield of common buckwheat in Mediterranean conditions: response to sowing time and irrigation. *Crop Pasture Science* 67, 1000–1008. DOI: 10.1071/CP16091.

Moreira, B., Gonçalves, A., Pinto, L., Prieto, M.A., Carocho, M., Caleja, C. & Barros, L. (2024). Intercropping systems: An opportunity for environment conservation within nut production. *Agriculture* 14, 1149–1173. DOI:10.3390/agriculture14071149.

Nwajei, S.E., Omoregie, A.U., Ogedegbe, F.O. (2019). Effects of planting dates on the growth and yield of two indigenous varieties of pearl millet (*Pennisetum glaucum* (L) R.Br.) in a forest-savanna transition Zone of Edo State, Nigeria. *Acta Agriculturae Slovenica* 114, 169–181. https://doi.org/10.14720/aas.2019.114.2.3

Omoregie, A.U., Nwajei, S.E. and Iredia, B.E. (2020). Effects of planting density on the growth and forage yield of two varieties of millet (*Pennisetum typhoides* Burm. F.) grown in Ekpoma, Nigeria. *Sustainability, Agri, Food and Environmental Research* 8, 118–128. DOI: 10.7770/safer-V0N0-art1737

Qu, Y. & Feng, B. (2022). Straw mulching improved yield of field buckwheat (*Fagopyrum esculentum* Moench) by increasing water-temperature use and soil carbon in rain-fed farmland. *Acta Ecologica Sinica* 42, 11–16. DOI: 10.1016/j.chnaes.2020.11.008.

Sun, T., Li, Z., Wu, Q., Sheng, T. & Du, M. (2022). Effects of alfalfa intercropping on crop yield, water use efficiency, and overall economic benefit in the Corn Belt of Northeast China. *Field Crops Research* 216, 109-119. https://doi.org/10.1016/j.fcr.2017.11.007

Virilia, A., Marusiga, D.B., Vedovea, G.D. & Marraccinia, E. (2024). Buckwheat (*Fagopyrum esculentum* Moench.) as an emerging companion crop in annual cropping systems: A systematic review. *Italian Journal of Agronomy* 19, 1–7. DOI: 10.4081/ija.2024.2218.

Wortman, S.E., Francis, C. A. & Lindquist, J.L. (2012). Cover crop mixtures for the western corn belt: opportunities for increased productivity and stability. *Agronomy Journal* 104, 699–705. DOI: 10.2134/agronj2011.0422

Woźniak, M., Liszewski, M., Jama-Rodzeńska, A., Gębarowska, E., Siebielec, S., Kaczmarek, A., Gałka, B., Zalewski, D. & Bąbelewski, P. (2025). Effect of *paulownia* and buckwheat intercropping on soil microbial biodiversity, dehydrogenase activity, and glomalin-related soil protein. *Agronomy* 15, 888–896. DOI: 10.3390/agronomy15040888

Zhang, G., Yang, Z. & Donga, S. (2011). Interspecific competitiveness affects the total biomass yield in an alfalfa and corn intercropping system. *Field Crops Research* 124, 66–73. DOI: 10.1016/j.fcr.2011.06.006

IZVLEČEK

Rast in pridelek biomase navadne ajde (*Fagopyrum esculentum* (L.) Moench) pri različnih sistemih pridelovanja

Gojenje rastlin kot pokrovnih ali spremljevalnih kultur ter za zeleno gnojenje je osnova trajnostne in ekološke pridelave poljščin. Tak način pomaga zmanjševati degradacijo tal in podpira trajnostno upravljanje s tlemi. Namen tega poskusa pridelovanja je bil oceniti vpliv sistemov pridelovanja rastlin na rast in pridelek biomase dveh kultivarjev navadne ajde. Testirani sistemi upravljanja s pridelkom so bili: navadna ajda (kultivarja Zoe in Harpe) kot samostojen posevek (kontrola), v vmesnem posevku s sirkom (*Sorghum bicolor*), v vmesnem posevku z mešanico facelije (*Phacelia tanacetifolia*) in bele gorčice (*Sinapis alba*), ter gojena z ostanki pšenice po žetvi (slama). Poskus je bil zasnovan v popolnoma randomiziranem bloku s tremi ponovitvami. Podatki so bili zbrani o višini rastlin (cm), številu listov na rastlino, številu vej na rastlino, skupni površini listov na rastlino (cm^2), premeru stebla (cm) in pridelku biomase (t/ha). Načini pridelovanja so imeli pomemben vpliv na število vej na rastlino, premer stebla in skupni pridelek biomase ajde. Najvišji pridelek biomase (1,13 t/ha sušine) je bil dosežen pri sorti Harpe, posejani z vmesnim posevkom facelijo in belo gorčico, medtem ko je bila najnižja vrednost 0,71 t/ha ugotovljena v kontrolni skupini. Glede na visoke pridelke biomase je skupna setev ajde z mešanico facelije in bele gorčice obetavna možnost za pridelavo zelene mase za podor. Čeprav sta se sorti ajde razlikovali po številu listov, površini listov in številu vej na rastlini, uporabljeni sorti nista imeli značilnega vpliva na pridelek biomase.