Journal of Natural Science Review

Vol. 3, No. 1, 2025
https://kujnsr.com
e-ISSN: 3006-7804

The Growth and Yield of Potatoes as Influenced by Planting Dates and Varieties under Dry Temperate Climate

Hamid Salari✉[1], Ahmad Jawid Zamany[2], Zainullah Hazim[3]

[1.2] Horticulture Department, Agriculture Faculty, Kabul University, Kabul, Afghanistan
[3]Horticulture Department, Agriculture Faculty, Bamyan University, Bamyan, Afghanistan
✉E-mail: h.salari@ku.edu.af(corresponding author)

ABSTRACT

This investigation aimed to study the effect of planting dates and variety on plant growth and yield of potatoes. The experiment was conducted in 2023 at the Agriculture Research Farm of Kabul University. The study was designed in a split-plot, using a Randomized Complete Block Design (RCBD), and data for plant growth and yield was recorded. Statistical Tools for Agricultural Research (STAR) software analyzed the recorded data statistically. The findings of this investigation reveal that early planting dates increase the yielding capacity of potatoes. The performance of varieties regarding growth and yield was different, and variety Milva recorded the most significant plants and highest yield among all other varieties. Milva, on the early planting date, produced vigorous plants and larger tubers and recorded significantly higher yields than other varieties. Faransawi and Laura were second and third best performers after variety Milva, especially when grown in early planting dates (20th March). Based on the study's findings, it is recommended that farmers grow varieties Milva, Faransawi, or Laura on early planting dates for a higher yield of potatoes in dry temperate agro-climatic conditions.

ARTICLE INFO

Article history:

Received: February 3, 2025
Revised: March 11, 2025
Accepted: March 11, 2025

Keywords:

Growth response; Planting date; Solanum tuberosum Variety; Yield response

To cite this article: Salari, H., Zamany, A. J., & Hazim, Z. (2025). The Growth and Yield of Potatoes as Influenced by Planting Dates and Varieties under Dry Temperate Climate. *Journal of Natural Science Review*, 33–44. DOI: https://doi.org/10.62810/jnsr.v3i1.182

Link to this article: https://kujnsr.com/JNSR/article/view/182

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the world's most cultivated high-value cash crops. It is the fourth most important food crop after rice, wheat, and maize. Potatoes are an annual vegetable that completes its life cycle within a single growing season. Potatoes are starchy tubers that contain 74.7, 22.6, and 1.6 percent water, carbohydrates, and proteins, respectively. One hundred grams of potato produces 90 Kcal energy. Potatoes contain vitamins and minerals (Górska-Warsewicz et al., 2021; Thamburaj, 2017). Potatoes are contributing to Afghans' nutritional and food security. The average annual per capita

consumption of potatoes in Afghanistan is 22.26 kilograms (Potato Production and Consumption, 2025).

Potatoes are grown commercially in Afghanistan. The area under its cultivation in 2022 was 56000 hectares, and its production reached 889000 metric tons. Potato production in Afghanistan is concentrated in nine provinces, including Bamyan, Nangarhar Panjsher, Parwan, Samangan, Sarepul, Takhar, Uruzgan, and Wardak. However, over 50 percent of production is from Bamyan province alone (Honaryar, 2019). In 2022 Afghanistan exported potatoes worth 1.15 million United States dollars to Uzbekistan, Kyrgyzstan, and Pakistan. Afghanistan imported 48.6 million United States dollars in the same year, mainly from Pakistan (Potato Production and Consumption, 2025).

Environmental conditions significantly affect potato growth and yield. Afghanistan's agroclimatic conditions are ideally suitable for good-quality potato production. In high mountain valleys, the potatoes are primarily grown in spring, and in the plains, they are grown during fall on irrigated lands. The seed potatoes are obtained from the spring potatoes for the fall and following spring planting (Adhikari et al., 2020; Potato Production and Consumption, 2025).

Commonly cultivated potato varieties include tetraploid (2n = 4x = 48) with a basic chromosome number of 12, while there are cultivated species at the diploid (2n = 2x = 24) to pentaploid (2n =5x = 60) levels. The triploid and pentaploid cultivated species are grown only on highland plateaus and slopes of the Andes. Still, diploid-cultivated species are grown more widely and are used to breed tetraploid varieties (Watanabe, 2015).

The major potato varieties in Afghanistan are Samadi, Safidgul, Sabzgul, C-3127, and Kufri Chandaramokhi (KCM). Cardinal and Desiree are two other major varieties with red skin that were also previously released in the country. Among the aforementioned varieties, Samadi is the best and highest-yielding variety, producing higher yields with quality tubers. It is also highly resistant to pests and diseases (Hakimi, 2018). In 2020, the Ministry of Agriculture, Irrigation and Livestock of Afghanistan released four new varieties of potatoes, including Faransawi (Kuroda), Sadaf (Chipsona), Germani (Agria), and Bamyan (Himalini) (Hakimi, 2021).

Most farmers prefer varieties that are long-storable. Farmers' interest has recently increased in potatoes suitable for different uses, such as making chips, French fries, roasted potatoes, and various types of potato foods. The variety of Kufri Chipsona is recommended for chipping in India (Singh et al., 2010).

Lower productivity is a major problem in most potato-growing regions. This could be overcome by selecting a well-adopted variety grown at an appropriate planting date. The objective of this study was to evaluate six potato varieties on three planting dates to find the highest-yielding variety and proper planting date for the agro-climatic conditions of Kabul province, Afghanistan.

MATERIAL AND METHODS

This investigation was conducted at the agriculture research farm of Kabul University from March to December 2023. The investigation site is located at latitude 34.5184°N and longitude 69.1394°E. The site is located approximately 1,810 meters above mean sea level (Safi et al., 2016). The site's climate is dry temperate, with a hot summer and cold winter (Salari et al., 2020). The growing season in the region starts in April and extends until November. Table 1 presents the average weather data for the experimental site, based on the mean values from 2001 to 2020.

*Table 1: Average weather data of the experiment site (POWER Data Access Viewer, 2025) and *(Sunrise and Sunset in Afghanistan, 2024)*

Month	Temperature (ºC)	Relative Humidity (%)	Day length (hours)*	Rainfall (mm)
January	-0.6	52.71	10.1	39.78
February	0.72	58.88	11.0	64.98
March	6.8	55.43	11.6	77.72
April	12.11	51.09	13.1	79.24
May	16.64	43.82	14.0	47.82
June	20.69	32.83	14.3	29.69
July	22.98	29.29	14.2	34.47
August	21.87	29.63	13.3	42.41
September	17.89	29.74	12.3	33.11
October	12.48	32.69	11.2	25.49
November	6.64	40.5	10.3	27.73
December	2.02	45.44	9.5	18.95

The investigation was conducted in a Split-Plot Randomized Complete Block Design (RCBD) with 18 treatments, each replicated thrice. The planting dates at three levels (20th March, 29th March, and 8th April) were applied randomly in the main plots. The varieties at six levels (Faransawi, Milva, Bamyan, Sadaf, Laura, and Germani) were allotted randomly in subplots.

The recommended dose of nitrogen (200 kg ha-1), phosphorus (115 kg ha-1), and farmyard manure (15 t ha-1) were commonly applied to all the plots. Based on climatic conditions, the plots were irrigated once each 7-10 days using a standard furrow irrigation method. The tubers were cut into pieces and were planted on ridges with rows spaced 70 cm apart and an in-row plant distance of 25 cm. The weeds were controlled by hand weeding. The plants were sprayed with 0.2 % Mancozeb fungicide solution to prevent fungal diseases. The earthing-up process was completed when the plant height was about 20 cm. The tubers were manually harvested with human labor.

The parameters on plant growth were recorded 90 days after planting. The number of leaves and stems per plant was manually counted in three selected plants from each treatment. The plant height was measured in centimeters from the base to the tip of the stem. Leaf area was estimated from leaf length and width based on the formula (1) given by (Mikias Yeshitila & Taye, 2016).

$$Leaf\ area\ (cm^2) = 13.9633 + 1.662 Leaf\ length(cm) + 5.2688 Leaf\ width(cm) \quad (1)$$

leaf area per plant was recorded from three randomly labeled plants in each treatment and was presented as square centimeters per plant. Leaf area index (LAI) was calculated by dividing the actual leaf area per plant by the land area occupied by the same plant using the formula (2) given by (Watson, 1952).

$$LAI = \frac{\text{Leaf area per plant } (\text{cm}^2)}{\text{Land area occupied by each plant } (\text{cm}^2)} \quad (2)$$

The number of plants that emerged after planting were manually counted and presented in percent. For the maturity period, the number of days from planting to harvest for each treatment was counted and presented in days. Large bulbs (more than 150 grams) suitable for fresh use and small bulbs (less than 150 grams) suitable for seed use and total yields were recorded in kg per plot and presented in metric tons per hectare.

The Statistical Tool for Agricultural Research (STAR) software version 2.0 was used to analyze the data obtained. The differences between treatments were compared using Least Significant Difference (LSD) at p≤0.05.

RESULTS AND DISCUSSIONS

Plant Height

Planting dates had no significant effect on plant height (Table 2). However, a statistically significant difference was observed among the studied varieties (Table 2). The Milva variety exhibited the greatest plant height (70.89 cm), while the shortest plants were recorded for Sadaf (52.18 cm), likely due to Milva's superior adaptation to the climatic conditions of Kabul province. The interaction between planting dates and varieties was also found to be non-significant (Table 2). Similar findings have been reported by (Ahmed et al., 2017; Asnake et al.; 2023; and Dash et al., 2018), who attributed differences in variety performance to genetic variation and its interaction with agro-climatic conditions.

Number of Leaves Per Plant

None of the studied factors and their interactions significantly influenced the number of leaves per plant (Table 2).

Number of Stems Per Plant

The effect of planting dates on the number of stems per plant was insignificant. However, varieties had significant differences in the number of stems per plant. The highest number of stems per plant (3.81) was recorded for the variety Milva, and the lowest (2.73) was recorded

for the variety Faransawi (Table 2). Milva is a late maturing variety, and its plant growth is relatively higher than other varieties, while the Faransawi variety is early maturing and produces relatively smaller plants. The interaction between planting dates and varieties had a non-significant effect on the number of stems per plant. These findings are consistent with previous studies (Dash et al., 2018; Haile et al., 2015; Teweldemedhin Keleta et al., 2020), which reported that differences in stem production are primarily influenced by the genetic characteristics of each variety rather than external planting conditions.

Leaf Area Per Plant

The planting date, the varieties, and their interaction had a non-significant effect on the leaf area per potato plant (Table 2).

Leaf Area Index

None of the studied factors and their interactions significantly influenced the leaf area index (Table 2).

Table 2: The growth of potato plants as influenced by planting date and varieties

Treatment	Plant height (Cm)	Number of leaves per plant	Number of stems per plant	Leaf area per plant (Cm2)	Leaf area index
			Planting date (A)		
20-Mar	52.94	68.89	3.28	4288.01	3.06
29-Mar	59.72	85.65	3.15	5390.66	3.85
08-Apr	63.85	83.37	3.02	5414.20	3.87
F-test	N.S.	N.S.	N.S.	N.S.	N.S.
LSD0.05					
CV (%)					
			Variety (B)		
Faransawi	55.00 b	76.41	2.73 b	4846.51	3.46
Milva	70.89 a	81.66	3.81 a	5071.27	3.62
Bamyan	57.15 b	88.19	3.00 b	5963.67	4.26
Sadaf	52.18 b	59.59	2.85 b	3928.32	2.81
Laura	59.63 b	86.30	3.00 b	5348.17	3.82
Germani	58.18 b	83.66	3.48 ab	5027.79	3.59
F-test	*	N.S.	*	N.S.	N.S.
LSD0.05	10.61		0.74		
CV (%)	18.73		24.73		
			Interaction		
A×B	N.S.	N.S.	N.S.	N.S.	N.S.

* and N.S. represent significant and non-significant, respectively. According to LSD at the 0.05 level, the means within the same column for each factor followed by the same letter are not significantly different.

Plants Emergence

The date of plating had a significant (P< 0.05) influence on the percentage of plants that emerged (Table 3). Early planting date recorded a higher percentage of emerged plants (84.66 %); this reduced with delay in planting date, and the lowest plant emergence (64.81

%) was recorded in late planting. This might be due to optimum temperature and humidity for better plant growth. The response of varieties was also significant regarding plant emergence (Table 3). The highest plant emergence (84.66 %) was recorded for the variety Milva, and the lowest (53.44 %) was recorded for the variety Sadaf (Table 3). Variety Milva had more eyes than other varieties, giving it a higher chance to produce a plant. The interaction of planting date and varieties was non-significant. The results align with those (Jones & Allen, 1983; and Teweldemedhin Keleta et al., 2020), who reported that an increased number of eyes on tubers increases the chance of plant emergence.

Maturity Period

The planting date did not significantly affect the maturity period of potatoes (Table 3). The varieties showed statistically significant responses regarding the maturity period (Table 3). Milva matured in the longest period (171.78 days), while the variety Laura matured in the shortest period (148.67 days). This is due to genetic variation in varieties, which influences their maturation. Milva is a late maturing variety, while Laura is genetically early maturing.

The interaction of planting date and varieties significantly influenced the maturation period of the potato crop. Varieties Milva, Sadaf, and Laura took longer to mature when they were grown on early planting dates, and a delay in planting dates reduced the maturation period for these varieties. On the other hand, the variety of Bamyan took longer to mature when it was grown on late planting dates (Tables 4 and 5). The results align with (Asnake et al., 2023; Dash et al., 2018; Likhnenko et al., 2020), who reported that genetic variation in plants influences their maturation period.

Table 3: Maturity period (days) and plant emergence (%) of potatoes as influenced by date of planting and varieties

Treatment	Maturity period (days)	Plants emergence (%)
	Planting date (A)	
20-Mar	159.50	84.66 a
29-Mar	157.83	75.93 ab
08-Apr	155.11	64.81 b
F-test	N.S.	*
LSD0.05		13.7
CV (%)		19.7
	Variety (B)	
Faransawi	156.44 bc	76.19 a
Milva	171.78 a	84.66 a
Bamyan	160.22 b	75.66 a
Sadaf	150.00 c	53.44 b
Laura	148.67 c	79.36 a
Germani	157.78 bc	81.48 a
F-test	**	**
LSD0.05	9.35	13.7
CV (%)	3.66	15.64
	Interaction	
A×B	**	N.S.

** and N.S. represent highly significant and non-significant, respectively. According to LSD at the 0.05 level, the means within the same column for each factor followed by the same letter are not significantly different.

Table 4: Comparison of planting date at each level of variety regarding maturity period

		Variety					
		Faransawi	Milva	Bamyan	Sadaf	Laura	Germani
Planting date	20-Mar	154.00 a	183.00 a	154.00 b	154.00 a	154.00 a	158.00 a
	29-Mar	157.00 a	168.33 b	162.66 ab	153.00 a	149.00 ab	157.00 a
	08-Apr	158.33 a	164.00 b	164.00 a	143.00 b	143.00 b	158.33 a

Table 5: Comparison of variety at each level of planting date regarding maturity period

		Planting date		
		20-Mar	29-Mar	08-Apr
Variety	Faransawi	154.00 b	157.00 ab	158.33 a
	Milva	183.00 a	168.33 a	164.00 a
	Bamyan	154.00 b	162.66 ab	164.00 a
	Sadaf	154.00 b	153.00 b	143.00 b
	Laura	154.00 b	149.00 b	143.00 b
	Germani	158.00 b	157.00 ab	158.33 a

Number of Tubers Per Plant

The planting date did not significantly affect the number of tubers per plant (Table 6). However, the response of the variety regarding the number of tubers per plant was highly significant (Table 6). Variety Milva produced the highest number of tubers per plant (6.94), and variety Bamyan and Sadaf produced the least number of tubers per plant (3.91). This is due to the vigorous growth of the Malva variety. Authors (Asnake et al., 2023; Dash et al., 2018; Haile et al., 2015) report the variation in response of varieties.

Average Tuber Weight

The planting date did not significantly influence the average tuber weight of potatoes (Table 6). However, the varieties showed significant responses regarding average tuber weight (Table 6). The largest tubers (76.67 g) were produced by the variety Faransawi, and the most minor (45.41 g) were produced by the variety Bamyan. The genetic characteristics of varieties and their response to specific climatic conditions might be the reason for the difference in bulb size. The author (Khan et al., 2024) also reported that genetic characteristics of varieties influences the size of tubers.

Yield Per Plant

The planting date did not significantly influence the yield per plant (Table 6). Regarding yield per plant, the response of different varieties was significant (Table 6). The highest yield per plant was produced by the variety Milva (0.36 kg), which was on par with the variety Faransawi (0.32 kg), and the lowest was produced by the variety Bamyan (0.18 kg). Better adaptability of Milva and Faransawi varieties to the region's climatic conditions might be the reason for higher-yielding. Similar findings have been reported by Khan et al. (2024), who

emphasized that the interaction between genotypes and environmental conditions plays a crucial role in determining the yielding capacity of potatoes.

Small Tubers

The yield of small tubers was significantly influenced by planting date (Table 6). The highest yield (6.91 Mt/Ha) was recorded on the second planting date (29th March), and the lowest (4.28 Mt/Ha) was recorded on the late planting date (8th April). This is interrelated with the total yield; since the total yield was highest on the second planting date, the yield of small tubers was also increased on the same planting date. Previous studies (Ahmed et al., 2017; Dash et al., 2018; Teweldemedhin Keleta et al., 2020) have reported similar trends, highlighting that earlier planting dates positively impact total and small tuber yield due to favorable growing conditions.

Large tubers

The planting date did not significantly influence the yield of large tubers (Table 6). However, the response of varieties was significant (Table 6). The highest yield of large tubers (8.63 Mt/Ha) was produced by the variety Faransawi, which was on par with the variety Milva (8.27 Mt/Ha), and the lowest (3.06 Mt/Ha) was produced by the variety Sadaf. This was interrelated with the average tuber weight since the varieties Faransawi and Milva produced larger tubers; thereby, the yield of large bulbs was also increased under these varieties. These findings are consistent with those of **Dash et al. (2018) and Khan et al. (2024)**, who also reported that variety selection significantly affects tuber size and yield under different environmental conditions.

Total Yield

The date of planting had a significant ($P< 0.05$) influence on the total yield of potatoes (Table 6). The second planting date (29th March) produced the highest total yield (13.07 Mt/Ha), and the third planting date (8th April) produced the lowest (9.50 Mt/Ha). Ideal weather might be the reason for the higher yield of potatoes under early planting dates.

The variety significantly ($P< 0.05$) influenced the total yield of potatoes (Table 6). The highest (19.01 Mt/Ha) and the lowest (6.21 Mt/Ha) total yield was recorded under varieties Milva and Sadaf, respectively (Table 8).

The interaction of planting dates and varieties was also significant (Table 6). The variety Milva on the first planting date (20th March) produced the highest total yield (21.81 Mt/Ha), and the variety Sadaf on the third planting date (8th April) produced the lowest (3.62 Mt/Ha) total yield (Table 7 and 8). The better response of varieties to the region's agro-climatic conditions might be the reason for the higher yielding of the Milva variety. On the other hand, the more extended maturation period of the variety might have caused the higher yielding capacity. These findings align with previous studies (Asnake et al., 2023; Haile et al., 2015; Kawakami et al., 2005; Teweldemedhin Keleta et al., 2020), which have consistently

demonstrated that the interaction between genotype and environment plays a critical role in determining the yield potential of potatoes.

Table 6: The influence of planting date and varieties on number of tubers per plant, average tuber weight (grams), yield per plant (kilograms), small tubers' yield (Mt ha-1), large tubers' yield (Mt ha-1) and total yield (Mt ha-1)

Treatment	Number of tubers per plant	Average tuber weight (g)	Yield per plant (Kg)	Small tubers (MT/Ha)	Large tubers (MT/Ha)	Total yield (MT/Ha)
Planting date (A)						
20-Mar	4.56	55.16	0.26	5.39 ab	6.44	11.82 ab
29-Mar	5.27	55.44	0.29	6.91 a	6.16	13.07 a
08-Apr	4.11	53.13	0.22	4.28 b	5.22	9.50 b
F-test	N.S.	N.S.	N.S.	*	N.S.	*
LSD0.05				1.58		2.58
CV (%)				16.34		12.05
Variety (B)						
Faransawi	4.10 b	76.67 a	0.32 a	5.27 bc	8.63 a	13.89 b
Milva	6.94 a	51.72 b	0.36 a	10.74 a	8.27 a	19.01 a
Bamyan	3.91 b	45.41 b	0.18 b	3.52 bc	3.62 b	7.14 cd
Sadaf	3.91 b	50.69 b	0.19 b	3.15 c	3.06 b	6.21 d
Laura	4.21 b	53.15 b	0.22 ab	4.24 bc	6.26 ab	10.50 bc
Germani	4.78 ab	49.81 b	0.25 ab	6.25 b	5.79 ab	12.04 b
F-test	**	**	**	**	**	**
LSD0.05	2.49	15.42	0.13	2.9	3.8	3.91
CV (%)	37.5	19.71	37.01	28.04	34.18	16.88
Interaction						
A×B	N.S.	N.S.	N.S.	N.S.	N.S.	**

** and N.S. represent highly significant and non-significant, respectively. According to LSD at the 0.05 level, the means within the same column for each factor followed by the same letter are not significantly different.

Table 7: Comparison of planting date at each level of variety regarding total yield (Mt ha-1)

		Variety					
		Faransawi	Milva	Bamyan	Sadaf	Laura	Germani
Planting date	20-Mar	14.27 a	21.81 a	4.99 b	6.5 ab	13.5 a	9.85 b
	29-Mar	12.52 a	19.62 a	9.06 a	8.5 a	10.65 ab	18.07 a
	08-Apr	14.87 a	15.60 b	7.37 ab	3.62 b	7.34 b	8.19 b

Table 8: Comparison of variety at each level of planting date regarding total yield (Mt ha-1)

		Planting date		
		20-Mar	29-Mar	08-Apr
Variety	Faransawi	14.27 b	12.52 bc	14.87 a
	Milva	21.81 a	19.62 a	15.60 a
	Bamyan	4.99 c	9.06 c	7.37 b
	Sadaf	6.5 c	8.5 c	3.62 b
	Laura	13.5 b	10.65 c	7.34 b
	Germani	9.85 bc	18.07 ab	8.19 b

CONCLUSION

The findings of this investigation reveal that early planting date increases the yielding capacity of potatoes. The performance of varieties regarding growth and yield was different, and variety Milva recorded the largest plants and highest yield among all other varieties. Milva, in the early planting date, produced vigorous plants and larger tubers and recorded significantly higher yields than other varieties. Faransawi and Laura were second and third best performers after variety Milva, especially when grown in early planting dates (20th March). Considering the investigation's findings, we recommend that the farmers grow varieties Milva, Faransawi, or Laura on early planting dates for a higher yield of potatoes under dry temperate agro-climatic conditions of Kabul province.

Acknowledgments

The authors thank the Department of Horticulture, Faculty of Agriculture, Kabul University, for their technical support.

Conflict of Interest: The authors declare that they have no conflict of interest.

REFERENCES

Adhikari, S., Srivastava, A. K., Sharma, M., & Shrestha, A. K. (2020). Response of potato clones to planting dates in Pokhara, Kaski, Nepal. *Journal of Agriculture and Natural Resources*, 3(2). https://doi.org/10.3126/janr.v3i2.32503

Ahmed, B., Sultana, M., Chowdhury, M., Akhter, S., & Alam, J. (2017). Growth and Yield Performance of Potato Varieties Under Different Planting Dates. *Bangladesh Agronomy Journal*, 20, 25. https://doi.org/10.3329/baj.v20i1.34878

Ahmed, K., Nawaz, M. Q., Hussain, S. S., Rizwan, M., Sarfraz, M., Wainse, G. M., & Jamil, M. (2017). Response of onion to different nitrogen levels and method of transplanting in moderately salt affected soil. *Acta Agriculturae Slovenica*, 109(2), Article 2. https://doi.org/10.14720/aas.2017.109.2.13

Asnake, D., Alemayehu, M., & Asredie, S. (2023). Growth and tuber yield responses of potato (Solanum tuberosum L.) varieties to seed tuber size in northwest highlands of Ethiopia. *Heliyon*, 9(3), e14586. https://doi.org/10.1016/j.heliyon.2023.e14586

Dash, S. N., Behera, S., & Pushpavathi, Y. (2018). Effect of Planting Dates and Varieties on Potato Yield. *International Journal of Current Microbiology and Applied Science*s, 7(3), 1868–1873. https://doi.org/10.20546/ijcmas.2018.703.221

Górska-Warsewicz, H., Rejman, K., Kaczorowska, J., & Laskowski, W. (2021). Vegetables, Potatoes and Their Products as Sources of Energy and Nutrients to the Average Diet in Poland. *International Journal of Environmental Research and Public Health*, 18(6), 3217. https://doi.org/10.3390/ijerph18063217

Haile, B., Mohammed, A., & Woldegiorgis, G. (2015). Effect of Planting Date on Growth and

Tuber Yield of Potato (Solanum tuberosum L.) Varieties at Anderacha District, Southwestern Ethiopia. *International Journal of Research in Agricultural Sciences*, 2(6), 2348–3997.

Hakimi, S. S. (2018). *Certified Seed Production Technology of Potatoes*. International Center for Agricultural Research in the Dry Areas (ICARDA). https://hdl.handle.net/20.500.11766/8156

Hakimi, S. S. (2021). *Four new high-yielding potato varieties released in Afghanistan by ICARDA and ARIA* | Request PDF. International Center for Agricultural Research in the Dry Areas (ICARDA) Link.

Honaryar, G. (2019). An economic analysis of production, marketing and value chain of potato in bamyan province. *International Journal of Research -Granthaalayah*, 7(10), Article 10. https://doi.org/10.29121/granthaalayah.v7.i10.2019.371

Jones, J. L., & Allen, E. J. (1983). Effects of date of planting on plant emergence, leaf growth, and yield in contrasting potato varieties. *The Journal of Agricultural Science*, 101(1), 81–95. https://doi.org/10.1017/S002185960003639X

Kawakami, J., Iwama, K., & Jitsuyama, Y. (2005). Effects of Planting Date on the Growth and Yield of Two Potato Cultivars Grown from Microtubersand Conventional Seed Tubers. *Plant Production Science*, 8(1), 74–78. https://doi.org/10.1626/pps.8.74

Khan, F. R., Gul, N., Malik, S. A., Idrees, M., Naseem, M., Rabi, F., Shamsullah, S., & Khan, Z. (2024). Agronomic Performance and Adaptability of Potato Varieties in Pishin: Multivariate Analysis for Sustainable Agriculture. *Journal of Xi'an Shiyou University, Natural Science Edition*, 20(5), 511–520.

Likhnenko, S. V., Zangieva, F. T., Morgoev, T. A., & Bekmurzov, B. V. (2020). (PDF) Ways to increase the adaptability of potato varieties in the North Caucasus. *AGRITECH III,* 548. https://doi.org/doi:10.1088/1755-1315/548/2/022038

Mikias Yeshitila, & Taye, M. (2016). Non-destructive Prediction Models for Estimation of Leaf Area for Most Commonly Grown Vegetable Crops in Ethiopia. *Science Journal of Applied Mathematics and Statistics*, 4, 202. https://doi.org/10.11648/j.sjams.20160405.13

Potato Production and Consumption. (2025). PotatoPro.com. Link

POWER Data Access Viewer. (2025). https://power.larc.nasa.gov/data-access-viewer/

Safi, Z., Khurram, S., & Shalizi, M. (2016). Wheat Yield Response to Potassium Sulfate Supplemental Doses in Urban Agriculture of Kabul, Afghanistan. *Asian Journal of Science and Technology*, 07, 3400–3405.

Salari, H., Hansra, B. S., & Saharwat, Y. S. (2020). Effect of cultural practices on quality and yield of onion (Allium cepa L. Var. Safid e Paisaye). *Journal of Ecoscience and Plant Revolution*, 1(1), 9–14. https://doi.org/10.37357/1068.jepr.1.1.02

Singh, S., Pandey, S., Kumar, D., Marwaha, R., Manivel, P., Kumar, P., Singh, B., & Bhardwaj, V. (2010). Kufri Frysona: First high yielding potato variety for French fries in India. *Potato Journal*, *37*(3–4), 103–109. https://epubs.icar.org.in/index.php/PotatoJ/article/view/32566

Sunrise and sunset in Afghanistan. (2024). Worlddata.Info. https://www.worlddata.info/asia/afghanistan/sunset.php

Teweldemedhin Keleta, B., Lal, S., & Naqvi, S. D. Y. (2020). Effect of planting dates and varieties on growth and yield of potato (Solanum tuberosum L.) in Hamelmalo area. *Chinese Journal Of Eco-Agriculture*, 13, 2018.

Thamburaj (editor) & Narendra Singh (editor) (with Public Resource). (2001). Textbook of Vegetables Tubercrops and Spices. Indian Council of Agricultural Research. http://archive.org/details/textbookofvegetaoounse_0

Watanabe, K. (2015). Potato genetics, genomics, and applications. *Breeding Science*, 65(1), 53–68. https://doi.org/10.1270/jsbbs.65.53

Watson, D. J. (1952). The Physiological Basis of Variation in Yield. In A. G. Norman (Ed.), *Advances in Agronomy* (Vol. 4, pp. 101–145). Academic Press. https://doi.org/10.1016/S0065-2113(08)60307-7