Revue Le Manager Vol. 12, N°02 : 2025
ISSN 2392-5345/E-ISSN 2661-7129
P.P : 331-359

Green technology Variety Improvement) A Way to Achieve Food Security in Algeria Case study of Sodia Hasnaoui Company - Sidi Bel Abbes

Received: 09-02-2025 Accepted: 02-06-2025

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Abstract:

Green technology is an essential solution for countries seeking to achieve sustainable food security under the pressures they suffer from due to difficult environmental and climatic conditions. This research paper aims to build a theoretical and analytical basis on the subject of agricultural technological innovations,

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highlighting the importance of businesses that specialize in agriculture and seedling or seed development, Sodia Hasnaoui Company-Sidi Bel Abbes, particularly enhancing varieties to achieve food security for nations.

We have concluded that improving seed varieties is an essential element in improving the quality of agricultural products and thus reducing losses, obtaining higher yields and yields, The necessity of investing in smart agriculture, developing agricultural systems to ensure the regular and permanent availability of food while ensuring that it is safe for the health of the consumer by encouraging scientific research in the fields of agriculture and food industries, and reconsidering ways of storing (freezer rooms).

Keywords: Green technology, variety improvement, food security, Sodia Hasnaoui Company.

Jel Classification Codes: Q13, Q18, Q16.

1. INTRODUCTION

Talking about agriculture is not an easy matter for several reasons because the Arab region faces many challenges from water scarcity, population growth, land degradation, drought, unsustainable energy consumption, food insecurity, and lack of waste management. These challenges are expected to be exacerbated by climate change and its negative effects, the long crises facing the region, and rapidly changing consumption patterns.

In an increasingly urban world, technology and innovation can be a crucial catalyst for transforming agricultural and food systems. These technologies and environmental innovations can lead to the adoption of so-called green or clean technologies or practices.

Technology and innovation contribute to making agri-food systems more efficient, inclusive and resilient in the face of urbanization, This is necessary to ensure that everyone has access to reasonably priced, healthful diets, and thus achieving food security and nutrition. Green technologies are developing globally and are gradually spreading. The most appropriate technologies for the local context should be chosen, taking into account trade-offs and synergies. It should also be noted that technology is evolving rapidly, and what is considered green technology today may no longer be so in the future. In this context, the following main problem comes to mind: **How can green technological innovations improve varieties achieve food security?**

- Importance of the study:

Arab countries or countries with difficult terrain are betting on encouraging smart agriculture by giving great importance to

specialized scientific research in the field of agriculture, and encouraging youth to participate in agriculturally oriented programs, The majority of emerging nations are interested in the topic of food security, on the one hand, so it is necessary to develop the agricultural sector with modern technical methods to improve and increase production and preserve the environment.

A set of sub-questions arise from this main question:

- What are the innovative technological practices in the agricultural sector?
- What are the ways to achieve food security?
- How can Sodia Hasnawi's smart agricultural technology achieve food security?

–**Hypothesis:**

- Improving seed varieties plays an important role in achieving food security
- There is a strong relationship between improving seed varieties and food security
- There is a statistically significant effect between smart agriculture, the technology of improving varieties, and achieving food security at a significance level of 5%.

- **The Objectif of the study:**

- Identify the role of variety improvement technology in reducing costs, reducing losses and increasing the productivity of agricultural products or crops;

- Identify smart agriculture as a modern trend in the agricultural field;

- Identify technology and innovations in the agricultural sector;
- The necessity of relying on smart agriculture as a strategic option to achieve food security;
- Identify technology and innovations in the agricultural sector provided by Sodia-Hasnawi Company.

The importance of the study:

The importance of the study lies in that it addresses a very important topic for the Algerian economy through smart agriculture (improving seed varieties), which the state is interested in and gives special attention to in its effort to achieve self-sufficiency and thus food security.

Methodology:

In our research, we relied on the descriptive approach based analysis, in which the theoretical aspect about smart agriculture, especially improving seed varieties and its role in enhancing food security, was presented through an applied study on the customers of the Hasnaoui Soda Company - Sidi Bel Abbes, using the SPSS research tool.

1.1. The conceptual framework of smart agriculture

Smart agriculture is considered an important and vital development in agricultural development policy, as it seeks to achieve a sustainable increase in agricultural production and adapt to the new reality imposed by weather patterns. The application of smart agriculture is a guarantee to reduce costs and increase

productivity by using less water in light of climate change, water shortages and scarcity of arable land, which leads to an increase in crop productivity by 50 percent according to the World Bank's expectations. Consequently, in the near future, the process of irrigation and fertilization of fields will be successful in an environmentally friendly manner.

- The concept of smart agriculture:

A novel idea that alludes to the application of Fourth Industrial Revolution technologies is smart agriculture, Using contemporary information and communication technology in farm management to increase production quality and quantity, streamlining the use of agricultural materials and improving their management efficiency. Therefore, smart agriculture is known as the third green revolution after the plant breeding and genetics revolution. The smart agriculture system depends on the use of modern technologies such as: remote sensing devices, geographic information systems, the Internet of Things, and unmanned aerial vehicles. (SAMAR, 2022),Artificial intelligence, data analysis and processing systems to improve the efficiency of farm management, starting from land leveling, through seeding, irrigation, fertilization, pest and disease control, and up to the final method, as smart agriculture technologies allow monitoring crop growth, identifying pests and diseases before they spread, and determining the amount of fertilizers and pesticides required, at the right time. (rachid & Yassine, 2023, pp. 308-327) , To apply it to the crop, as well as the appropriate irrigation dates and quantities required for each plant. This undoubtedly achieves high efficiency in farm management by making the appropriate decision at the appropriate time, which in turn has a positive impact on production and quality, maintains soil fertility, and reduces costs. Smart agriculture can be defined as a

system that relies on advanced technology to grow food in sustainable and clean ways, and rationalize the use of natural resources, especially water. One of its most prominent features is its reliance on information management and analysis systems to make the best possible production decisions, at the lowest costs, as well as automating agricultural processes such as irrigation, pest control, soil monitoring and crop monitoring. (https://www.awforum.org/index.php/ar).It is the application or use of modern technological tools in order to control various agricultural processes, such as assisting in plant growth and production, assisting in harvesting crops and protecting them from all possible damages. Technology should work to improve productivity, efficiency, profitability and sustainability of agricultural production. Adopting modern agricultural technology systems contributes to:Adopting modern agricultural technology systems contributes to: (walsalama, p. 07) Increase agricultural production rate; rationalize water consumption; maintain plant health and protect against pests; Reduce the amount of pesticides and fertilizers used; enhance the efficiency with which agricultural machinery is used; enhance the yield of crops; lowering the rate at which agricultural products are lost; Enhancing agricultural products' quality and specifications; Reducing other operational costs; Monitoring the field condition and monitoring climate changes effectively and accurately.

The Arab Organization for Agricultural Development's report highlights the significance of smart agriculture, lies in the following: (Faiza, 2022, p. 359)

- Improving the efficiency of using agricultural inputs such as fertilizers, pesticides and irrigation water;

- Better control of costs and ensuring the profitability of agricultural projects;
- Helping to make decisions quickly based on mobile phone software;
- Direct link to market data through information software to make the right decision to market products;
- Monitoring livestock, monitoring their health status and diagnosing diseases with the least cost and effort.

- Innovations and technological advancements in agriculture:

The modern focus shifted from "what does it produce?" To "What and how is it produced?" Or from "What do we learn?" To "What and how to learn?" Because information changes, it is useless to store it in our minds compared to gaining the skills to think, research, identify and solve problems. The power of technology is in managing it, not owning it. Hence the definition of technology as a way of thinking and solutions to problems through the optimal use of scientific knowledge and its applications to satisfy human need and increase its capabilities, that is, it is a means and not a result.

There are a number of green innovations and practices that can be adopted and applied throughout the Arab region, such as the Nano Clay Liquid; Smart irrigation; Solar energy; Vertical farming; Integrated production systems; Wastewater treatment and reuse; Improvement of items; Reuse of organic waste; Agriculture/urban horticulture; Fertilization by worms or worm dung.

- **Improved items:**

The United Nations Food and Agriculture Organization says that in order for farmers around the world to be more productive, they should have access to seeds, climate-resilient and nutrient-

dense crop types if they can boost output by 50% of the food required for the world's population without quality seeds, which are the basis of agricultural and food systems and are used to create food, Feed, fibre and fuel contribute to a friendly environment and improving seed quality makes it resilient to climate stress. Improving the use of natural resources and enhancing food security contribute greatly to greater crop production, economic development and farmers' incomes. (FAO)

The importance of seed technology is highlighted by the fact that it establishes the scientific methods of seed production, harvesting, testing, packaging, storage and marketing. Since the aim of this science is to prepare high-quality seeds, This means seeds of high-yielding varieties, and varieties resistant to diseases and insects in addition to increasing agricultural production by providing high-quality seeds and ensuring the rapid multiplication of seeds of desirable varieties as this technology will provide seeds in a timely manner, That is, well in advance of the planting season and at affordable prices.

Seed technology is interested in studying seed production and marketing processes. Any study of post-harvest ripening processes, seed storage processes, preservation of seed varieties from storage and transportation conditions, and preparation for the production of healthy seeds suitable for cultivation at high rates, Which means that high-quality, one of the most crucial inputs to the advancement of agriculture is seeds. Before being stored, seeds go through a number of stages, including harvesting, drying, cleaning, filling, and storage. The primary goal of seed storage is to preserve seeds for one to multiple seasons. In all these stages, it must be taken into account that these seeds contain embryos waiting for their role in growth to complete another season and are

of good quality and can't store the seeds of this quality only if they overcome All previous stages have encountered risks. (Amira & Habiba, 2019)

The seeds' strength and the percentage of germination in the highest proportion during this stage, of physiological survival and then begins deterioration continues with time until the seeds die and can reduce the deterioration to the minimum, but can't be stopped permanently because the passage of time is the age of each living organism and with the passage of time deterioration occurs, the seeds can die after several weeks of maturity and can retain their vitality for several years if available It has ideal conditions for storage. As for the age of the seed, it varies by type, and the weather and environmental conditions experienced by it before storage have an effective impact on storage capacity. Here, it is necessary to address the activation of seeds, which is a common transaction to reduce the time between planting seeds and the emergence of seeds, as it leads to the acceleration and homogenization of germination and field emergence, as well as improving field establishment. (Obtaining optimal vegetation density) under a wide range of environmental conditions, reducing bush competition, injury to other agricultural pests, and early and homogeneous maturation, resulting in less waste during harvest and thus an increase in yield. Vegetable plants, flowering plants and some field crops can get the most soil moisture, nutrients, solar radiation and early ripening to reach the maximum possible yield and the best quality, but it does not increase the total germination (total germination). (https://www.uoanbar.edu.iq/AgricultureCollege)

Scientists are working on the development of high-yielding seed varieties, more nutrient-dense and more capable of adjusting

to climate change and drought, thereby overcoming environmental obstacles, there are different types of improved seeds, as well:

Pollination of open seeds, hybrid seeds, and genetically modified seeds. produce pollination in a natural way through random pollination Hybrid seeds are produced by hybridizing two main plants with the desired properties, But these seeds maintain their high yield potential in just the first year. Then they lose their effectiveness in the second generation, so farmers need to buy new seeds every year. Genetically modified seeds are produced by transferring one or two genes that have the required traits. From live plants directly to the genome of the other plant but modified seeds It doesn't have much acceptance because it's thought to carry significant health risks. (ZALAMA, 2022)

Seed transactions and advanced technologies are a powerful tool for addressing difficulties and contributing to sustainability of agriculture and food security, so that improving seed quality and resistance to extreme conditions is crucial in sustainable farming under rising temperatures. Genetic technologies are being developed to improve heat-related seed qualities, such as high heat tolerance and drought resistance. Thanks to these technologies, seeds can be developed that withstand higher temperatures, are salinity-resistant, drought-resistant, withstand long dry periods and need less water and continue to grow and produce even in extreme climate conditions.

The seeds of natural, modified and endangered plants are collected and stored in seed banks, which contributes to the preservation of plant genetic diversity, this means that in the event of an environmental disaster or lack of natural resources, the plants can be restored and replanted using these stored seeds. In addition, researchers and scientists are developing innovative technologies to

improve seed transactions and increase their effectiveness in addressing environmental challenges.

- **Modern techniques used in improving seed coefficients:**

There are many modern techniques that are used to improve seed coefficients, and here are some examples of these techniques: (Nadia & Dalila, 2023, p. 226)

- Genomic technology: This technique is based on understanding the plant genome analyzed by DNA techniques;

- Gene editing technology: Utilized to alter plant genes, it can enhance seed characteristics like resistance to drought, increase water use efficiency, or improve climate adaptability;

- Modern genetic breeding techniques: Used to improve seed traits, this can be achieved by reducing development and reproduction periods and improving tolerance and resistance to harsh environmental conditions.

- Biotechnology technologies: Biotechnology technologies such as the use of nanotechnology and smart material technologies are explored to improve seed performance;

- Sustainable seed development techniques: They are used to preserve the genetic diversity of seeds;

- Advanced testing and evaluation techniques: They are used to Assess the quality of seeds (genetic, physical physiological and seed health quality) field performance in different conditions of environmental and climatic changes. There are other techniques that are also used in improving seed coefficients, such as climate development techniques; Physical processing techniques; Packaging and coating techniques; Comprehensive reduction techniques for diseases and pests; Simulation and forecasting techniques.

- The ingredients of green technology: Smart agriculture contributes to achieving food security and ensuring its sustainability through the principles on which it is based, specifically:

- Environmental preservation and conservation: By managing natural resources more effectively (sustainable resource use, better land and water, reduced use of chemicals, improved land mapping and enhanced water management; Improving productivity: This applies to productivity on the farm in terms of yield, as well as increasing management efficiency; Fostering innovation in agriculture: Smart farming techniques allow innovative production methods on the animal and plant side, and at different stages of production from farm to market; Attracting new investment: Due to natural diversity and the dry climate situation, investors are encouraged to resort to new agricultural techniques in difficult and harsh environments; Creating green jobs: Allows adaptation and reduction of greenhouse gas emissions; Improving agricultural crop quality and production will help reduce poverty and hunger ; Transformation of animal waste into biogas: An alternative and renewable source of energy; Creating climate resilient fisheries and aquaculture: Through storm-resistant fish cages and ponds, and adaptive fisheries management; Increasing revenue: Value chain transparency raises the standard of food safety confidence with traceability, leading to increased value in the market; Job creation: Create new jobs because new investors will join; Smart agriculture plays a dual role in reducing climate change and creating food sustainability. (el moubaraka, 2020)

1.1.1. The concept of food security

There is a point of convergence between security and food security, Security is meant to be reassured and protected and is one of the first basic needs that man seeks to achieve. Food is all that is suitable for human consumption, whether of animal or plant origin. (albayatii, 2016)

The concept of food security can be confined to two economic activities: Strategic food stocks; Food self-sufficiency. (Hussein, 2013, p. 18) Food security for members of the same state is to provide basic food for each individual at all times and conditions and no matter how the population increases, so that the balance between population and food remains in terms of quantity and type as the minimum calories needed per person per day is more than 2500 calories, and food balanced includes sugars, animal proteins, fats, salts and vitamins. (Al-Zarqati, 2007, p. 25)

2. Agricultural technology - improving varieties as a tool to achieve food security in Hasnawi Sodia Company

2.1. Definition of Sodia Hasanawi Foundation:

Sodia Hasnaoui Company is a company specialized in agricultural development in addition to its main field of activity in irrigation works and the environment. It has a great experience in the installation supply of geotextile membranes with pentonic. The company also provides services for the supply and installation of

high-density polyethylene earth membrane. Production facilities also include seedlings to meet the needs of producers, in terms of trees, fruits, and decorating plants. (Hasnaoui Group of Companies) Comprehensive aims to accompany its customers in each process of modernization of its activities, the quality of seedlings and irrigation system peasant machinery, in addition to improving productive efficiency, among products and services we find: Water, agricultural preparation, ((catalogues groupe-hasnaoui)).

2.2. **Technological innovations in Sodia Hasnawi Foundation**:

Due to the competitive environment that surrounds the institution and the knowledge that its strength lies in the methods of management used by HSMC therefore decided to adopt a quality policy to enhance and support the expertise it has built during 40 years of activity. It is this logic that HSMC decided to establish and maintain a comprehensive and complete approach to improving quality, respect for the environment and sustainable development according to the standards of: ISO 9001 version 2015, ISO 14001 version 2015. This decision means a radical change in all activities of the complex to provide quality, and respect for the environment is part of its great concern is a key factor to achieve the sustainable development of the Hasnaoui Partners Complex, to do so and to

achieve the goals to improve the performance of human, organizational and technical resources.

2.3. examination of the questionnaire's results analytically

dependability and consistency of the statistical instrument used to gather data (questionnaire).

- **Study Community:**

The community consists of a group of workers and peasants. The Hasanawi-Sodia Foundation, where 50 questionnaires were randomly distributed, 46 valid questionnaires were retrieved for analysis, two questionnaires were lost and two others were not retrieved, and through the spss program version 23 these data were analyzed in order to reach answers to sub-questions and deny or validate the study's hypotheses.

Consistency and reliability of the statistical tool for data collection (questionnaire).

Our first: Alpha-Kronbach coefficient

Measuring the stability of the questionnaire through the Alpha Kronbach coefficient

Table 01: Alpha Kronbach Test.

Variables Tested	Number of Phrases	The Alpha Cronbach Coefficient	Credibility questionnaire
Questionnaire	19	0,982	0,991

Source: SPSS outputs version 23.

Looking at the above table, we can see that the questionnaire's general stability coefficient is 0.982, which is extremely high and suggests that the questions are very stable. In other words, 98.2% of the results will be similar if the questionnaire is given to a second sample of the same size from the same community. Furthermore, the questionnaire's 99.1% validity rate indicates that the sample accurately reflects the community.

Our Second: Retail Halves

Our second: Stability with a questionnaire through the midterm segmentation method Table No. (02): Mid-Term Segmentation.

Stability coefficient Alpha Kronbach	Part One	Alpha Kronbach Value	0,977
		Number of paragraphs	07
	Part II	Alpha Kronbach Value	0,942
		Number of paragraphs	12
Total number of paragraphs			19
Link between Part I and Part II			0,977

Spryman Brown Laboratories	Of equal length	0,988
	Uneven length	0,988
Getman Laboratories		0,935

Source: SPSS outputs version 23.

we have the statistical results of the two parts as follows:

Table 03: Mid-Term Retail Statistics.

	Number of phrases	Arithmetic Mean	Variance	Standard Deviation
Part One	07	75,82	185,680	13,626
Part II	12	94,41	72,634	8,523
They're both together	19	170,23	485,136	22,026

Source: SPSS outputs version 23.

• Internal consistency of the first axis:

Agricultural technological practices and innovations

Table No. (04): Frequencies of answers to the questions of the first axis

Paragraphs	Answers	Repetitions	%	Paragraphs	Answers	Repetitions	%
1. Smart agriculture generates returns Higher investment?	Strongly Disagree	0	0,0	**2. Smart farming improves the efficiency of agricultural machinery ?**	Strongly Disagree	0	0,0
	Disagree	5	10,9		Disagree	15	32,6
	Neutral	7	15,2		Neutral	13	28,3
	Agree	19	41,3		Agree	16	34,8
	Strongly Agree	15	32,6		Strongly Agree	2	4,3
	Total	46	100,0		Total	46	100

3.Does automation of agricultural processes improve irrigation quality, pest control, soil monitoring and crop monitoring?	Strongly Disagree	0	0,0	**4.Smart agriculture reduce other operational costs?**	Strongly Disagree	0	0,0
	Disagree	3	6,5		Disagree	1	2,2
	Neutral	5	10,9		Neutral	9	19,6
	Agree	24	52,2		Agree	27	58,7
	Strongly Agree	14	30,4		Strongly Agree	9	19,6
	Total	46	100		Total	46	100
5.Smart agriculture rationalizes water consumption	Strongly Disagree	0	0,0	**6.Smart farming achieves higher returns on investment?**	Strongly Disagree	0	0,0
	Disagree	9	19,6		Disagree	0	0,0
	Neutral	8	17,4		Neutral	1	2,2
	Agree	20	43,5		Agree	29	63
	Strongly Agree	9	19,6		Strongly Agree	16	34,8
	Total	46	100,0		Total	46	100
7. Smart agriculture enables monitoring	Strongly Disagree	0	0,0%	**7. Smart agriculture enables monitoring**	Agree	23	50,0%
	Disagree	1	2,2%		Strongly Agree	19	41,3%
	Neutral	3	6,5%		Total	46	100,0%

Source: SPSS program outputs version 23.

•Variance and coefficient of variation for the first axis

Table No. (05): Question answers and their implications

Weighted arithmetic mean of answers	Direction	Acceptance level
From 1 to 1.79	Totally disagree	Totally disagree
from 1.8 to 2.59	Disagree	Disagree
From 2.6 to 3.39	neutral	neutral
From 3.4 to 4.19	appropriate	appropriate
From 4.2 to 5	Totally agree	Totally agree

Due to the use of a five-point Likert scale, the range between the means in the above table was determined by dividing the result by the largest weight (4/5=0.8) and then calculating the difference between the largest and smallest Likert scale weights (5-1=4).

Table No. 06: Analysis of the trend of answers

Paragraphs	Arithmetic mean	Contrast	Direction	Acceptance level	Standard deviation	coefficient of variation
Question 1	3,957	0,931	appropriate	acceptable	0,965	24%
Question 2	3,109	0,855	neutral	middle	0,924	30%
Question 3	4,065	0,685	appropriate	acceptable	0,827	20%
Question 4	3,957	0,487	appropriate	acceptable	0,698	18%
Question 5	3,630	1,038	appropriate	acceptable	1,019	28%
Question 6	4,326	0,269	Totally agree	Totally acceptable	0,519	12%
Question 7	4,304	0,483	Totally agree	Totally acceptable	0,695	16%

Source: SPSS program version 23.

As can be seen from the above table, when we examine the responses of the first axis, the weighted arithmetic mean for each paragraph, we find that the majority of the paragraphs were acceptable at the level of the answer, indicating that the general trend of the answers was "agree." When we compare the variance to the following scale, we find that there is a very high degree of agreement between the average response to each paragraph and the majority of respondents' responses to each paragraph. If the variance value in the paragraph is greater than 0.5, there is a disagreement of opinions; if it is greater than 0.5, there is a consensus of opinions.

Revue Le Manager Vol. 12, N°02 : 2025
ISSN 2392-5345/E-ISSN 2661-7129
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Axis II: Green Technology as a Tool for Achieving Food Security

Table No. (07): Frequencies of Answers to the Questions of the Second Axis

Paragraphs	Answers	Repetitions	percentage	Paragraphs	Answers	Repetitions	percentage
1.Does improving varieties increase agricultural production?	Strongly disagree	0	0,0%	7. Improved varieties reduce costs?	Strongly disagree	0	0,0%
	Disagree	0	0,0%		Disagree	0	0,0%
	Neutral	1	2,2%		neutral	2	4,3%
	acceptable	18	39,1%		acceptable	20	43,5%
	Strongly agree	27	58,7%		Strongly agree	24	52,2%
	Total	46	100,0%		Total	46	100,0%
2. Does improving varieties make seeds more resilient to climate change?	Strongly disagree	0	0,0%	8. Does improving varieties reduce the rate of loss of agricultural products?	Strongly disagree	0	0,0%
	Disagree	1	2,2%		Disagree	0	0,0%
	Neutral	0	0,0%		neutral	2	4,3%
	acceptable	22	47,8%		acceptable	29	63,0%
	Strongly agree	23	50,0%		Strongly agree	15	32,6%
	Total	46	100,0%		Total	46	100,0%
3. Improving the quality and specifications of agricultural products?	Strongly disagree	0	0,0%	9. Maintain plant health and protect against pests?	Strongly disagree	0	0,0%
	Disagree	0	0,0%		Disagree	0	0,0%
	Neutral	1	2,2%		neutral	2	4,3%
	acceptable	16	34,8%		acceptable	17	37,0%
	Strongly agree	29	63,0%		Strongly agree	27	58,7%
	Total	46	100,0%		Total	46	100,0%
4.Improving crop productivity?	Strongly disagree	0	0,0%	10. Saving the use of fertilizers and pesticides?	Strongly disagree	0	0,0%
	Disagree	0	0,0%		Disagree	0	0,0%
	Neutral	3	6,5%		neutral	2	4,3%
	acceptable	21	45,7%		acceptable	25	54,3%
	Strongly agree	22	47,8%		Strongly agree	19	41,3%
	Total	46	100,0%		Total	46	100,0%
5. Improving varieties that are salt-resistant, drought-resistant, tolerate long periods of	Strongly disagree	0	0,0%	11. Can it be used on all types of seeds and seedlings?	Strongly disagree	0	0,0%
	Disagree	0	0,0%		Disagree	0	0,0%
	Neutral	2	4,3%		neutral	1	2,2%
	acceptable	23	50,0%		acceptable	30	65,2%
	Strongly agree	21	45,7%		Strongly agree	15	32,6%

drought, and continue to grow and produce even in harsh climate conditions?	**Total**	46	100,0%		**Total**	46	100,0%
6. Improving varieties improves production and maintains soil fertility?	**Strongly disagree**	0	0,0%	**12. Do farmers need to have seeds of good varieties for more productive and nutritious crops?**	**Strongly disagree**	0	0,0%
	Disagree	0	0,0%		**Disagree**	0	0,0%
	Neutral	0	0,0%		**Neutral**	7	15,2%
	acceptable	18	39,1%		**Acceptable**	20	43,5%
	Strongly agree	28	60,9%		**Strongly agree**	19	41,3%
	Total	46	100,0%		**Total**	46	100,0%

Source: SPSS program outputs version 23.

• Variance and coefficient of variation for the second axis

Table No. (08): Question answers and their implications.

Weighted arithmetic mean of answers	Direction	Acceptance level
1 to 1.79	Strongly disagree	Totally unacceptable
1.8 to 2.59	Disagree	Unacceptable
2.6 to 3.39	Neutral	Average
3.4 to 4.19	Agree	Acceptable
4.2 to 5	Strongly agree	Totally acceptable

Due to the use of a five-point Likert scale, the range between the means in the above table was determined by dividing the result by the largest weight (4/5=0.8) and then calculating the difference between the largest and smallest Likert scale weights (5-1=4).

Table No. 9: Analysis of the trend of the answers of the second axis

Paragraphs	Mean	**Variance**	Trend	Acceptance Level	Standard Deviation	Coefficient of Variation
Question 1 of Axis 2	4,565	0,296	Totally agree	Totally acceptable	0,544	12%
Question 2 of Axis 2	4,457	0,387	Totally agree	Totally acceptable	0,622	14%
Question 3 of Axis 2	4,609	0,288	Totally agree	Totally acceptable	0,537	12%
Question 4 of Axis 2	4,413	0,381	Totally agree	Totally acceptable	0,617	14%
Question 5 of Axis 2	4,413	0,337	Totally agree	Totally acceptable	0,580	13%
Question 6 of Axis 2	4,609	0,243	Totally agree	Totally acceptable	0,493	11%
Question 7 of Axis 2	4,478	0,344	Totally agree	Totally acceptable	0,586	13%
Question 8 of Axis 2	4,283	0,296	Totally agree	Totally acceptable	0,544	13%
Question 9 of Axis 2	4,543	0,343	Totally agree	Totally acceptable	0,585	13%
Question 10 of Axis 2	4,370	0,327	Totally agree	Totally acceptable	0,572	13%
Question 11 of Axis 2	4,565	0,296	Totally agree	Totally acceptable	0,544	12%
Question 12 of Axis 2	4,457	0,387	Totally agree	Totally acceptable	0,622	14%

Source: SPSS program version 23.

By examining the responses to the second axis and the weighted arithmetic mean for each paragraph, we can see from the above table that all of the paragraphs were completely acceptable at the level of the answer, indicating that the overall trend of the answers was "completely agreed." As for the variance, we can see that there is a very high degree of agreement between the average response to each paragraph and the majority of respondents' responses to each paragraph when compared to the following scale: if the variance in the paragraph is less than 0.5, there is a consensus

of opinions; if it is greater than 0.5, there is a difference of opinions.

Hypothesis Testing

To answer the main hypothesis, the SPSS IBM version 23 program was used, by conducting a simple linear regression test on each of the variables to answer that.

One-way ANOVA test:

Test hypotheses:

Null hypothesis H0: There is no statistically significant effect between green technological innovations and food security factors at a significance level of 5%.

Alternative hypothesis H1: There is a statistically significant effect between green technological innovations and food security factors at a significance level of 5%.

Table No. 10: Fisher's test to determine the significance of the effect of green technological innovations and food security factors at a significance level of 5%.

Variables	Model	Degrees of Freedom	Sum of Squares	Mean Squares	Fisher Test Value	Significance	Decision
Green Technology Innovations and Food Security Factors	Regression	0,232	1	0,232	77,333	0,000	moral
	Residuals	0,135	44	0,003			
	Total	0,368	45				

Source: Outputs from IBM SPSS version 23.

From the table, the statistical significance value is equal to 0.000, i.e. less than 0.05. This means that the null hypothesis should be rejected and the alternative hypothesis should be accepted, which states that there is a statistically significant effect

between green technological innovations and food security factors at a significance level of 5%.

Table 12: Simple linear regression coefficients on the effect between green technological innovations and food security factors

Model	Transactions	Beta Coefficient
Fixed parameter	4,180	(-) 0,897
Independent variable parameter	- 0,225	

Source: Outputs from IBM SPSS version 23.

By conducting a simple linear regression test, a simple linear regression model was constructed.

By replacing the factors green technological innovations with X and the factors and food security factors with Y, we have the following:

$$Y= 4{,}0-180{,}225\ X$$

If the green technological innovation factors increase by one unit, the food security factors increase by 0.225, but if the green technological innovation factors are equal to 0, the food security factors are equal to 4.180.

- Conclusion:

As a summary of the impact of agricultural technological practices and innovations as a tool to achieve food security, we address the various results that have been reached at the end of our research and in this conclusion, a case study of the Sodia Hasnaoui Company - Sidi Bel Abbes as a model for Algerian institutions, to respond to the different subquestions in order to confirm the accuracy of the introduction's hypotheses and then try to present the results reached to provide recommendations and suggestions that can be used at the level of scientific study, which are as follows:

Hypothesis testing :

- Smart agriculture represents a powerful tool for enhancing food security by improving productivity, resource efficiency, and resilience to environmental challenge ;
- Yes, there is a strong and direct relationship between improving seed varieties and food security, as it leads to increasing productivity, tolerating environmental conditions, improving nutritional quality and diversifying crops: increasing farmers' incomes, developing agricultural techniques ;
- Yes, There is a statistically significant effect between smart agriculture, the technology of improving varieties, and achieving food security at a significance level of 5.

- **Recommendations :**

- Enhancing seed varieties is crucial to raising the caliber and standards of agricultural products, which lowers the rate of agricultural product loss and increases crop or yield and return;- Reviewing the methods of storing (frozen rooms) and marketing food products, including vegetables and fruits;

- By promoting scientific research in the domains of agriculture and food industries, one can help develop agricultural systems that guarantee a consistent and sustainable food supply while guaranteeing that it is safe for the consumer's health;

- Adapting agricultural products to climate change, which is one of the main causes of food scarcity;

- The government is focusing on expanding investment in the desert, especially strategic crops such as wheat, corn, grains, legumes, oil crops and fodder.

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