



Geographical Analysis of the Geographical Factors Affecting Agricultural Production

Case study in Elnuhoud Locality, West Kordofan State – Sudan

تحليل جغرافي للعوامل الجغرافية المؤثرة في الإنتاج الزراعي بمحلية النهود ولاية غرب كردفان – السودان

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Abstract:

This study examines the geographical factors influencing agricultural production in Elnuhoud Locality, West Kordofan State, Sudan. Its aim is to diagnose and analyze the geographical advantages and disadvantages (natural, human, and service-related) affecting the sustainability of agricultural production in Elnuhoud locality, West Kordofan State, Sudan, and to present a planning vision for addressing production imbalances and achieving sustainable development. The study employs a fundamental approach to examine the elements of the natural and human environments separately, a behavioral approach to interpret farmers' decisions and production and marketing practices, and a quantitative approach to statistically analyze field data and questionnaires. Among the most significant findings are: the vast majority of respondents (94.1%) acknowledge the existence of severe natural obstacles that govern the production process. Regarding human and service-related factors, the study reveals a high percentage of farmers practicing agriculture as a secondary activity (83.5%), and the prevalence of small and fragmented landholdings (1-5 plots, representing 44.7%), which hinders large-scale mechanization. The study recommended expanding rainwater harvesting projects, constructing earth dams and reservoirs, using drought- and heat-resistant fertilized seeds, implementing crop rotation systems, establishing modern refrigerated silos and storage facilities, and creating a regional crop exchange to break monopolies and ensure fair returns for farmers.

Keywords: Agricultural geography, agricultural production, Elnuhoud locality, West Kordofan, natural and human obstacles.



ملخص:

تناولت هذه الدراسة موضوع تحليل جغرافي للعوام الجغرافية المؤثرة في الإنتاج الزراعي بمحلية النهود ولاية غرب كردفان - السودان حيث هدفت هذه الدراسة إلى تشخيص وتحليل المقومات والمعوقات الجغرافية (الطبيعية، البشرية، والخدمية) المؤثرة في استدامة الإنتاج الزراعي بمحلية النهود في ولاية غرب كردفان بالسودان، وتقديم رؤية تخطيطية لمعالجة الاختلالات الإنتاجية وتحقيق التنمية المستدامة. اعتمدت الدراسة على المنهج الأصولي لدراسة عناصر البيئة الطبيعية والبشرية كل على حدة، والمنهج السلوكي لتفسير قرارات المزارعين وممارساتهم الانتاجية والتسويقية، إضافة إلى المنهج الكمي لتحليل البيانات الميدانية والاستبيانات إحصائياً. وأظهرت نتائج عديده من أهمها: الغالبية العظمى من المبحوثين (94.1%) يقرون بوجود معوقات طبيعية حادة تحكم العملية الإنتاجية. وعلى الصعيد البشري والخدمي، أظهرت الدراسة ارتفاع نسبة ممارسة الزراعة كنشاط ثانوي (83.5%)، وسيادة الحيازات الصغيرة والمتنقطة (1-5 مخمسات بنسبة 44.7%) مما يعيق الميكنة واسعة النطاق. وأوصت الدراسة بالتوسع في مشروعات حصاد مياه الأمطار وتشبيد السدود الترابية والحفائر، استخدام البذور المخصصة المقاومة للجفاف والحرارة وتطبيق نظام الدورة الزراعية. وإنشاء صوامع ومخازن حديثة مبردة وتأسيس بورصة إقليمية للمحاصيل لكسر الاحتكار وضمان عائد عادل للمزارعين.

الكلمات المفتاحية: الجغرافيا الزراعية، الإنتاج الزراعي، محلية النهود، غرب كردفان، المعوقات الطبيعية والبشرية.

Introduction

“And a sign for them is the dead earth. We have brought it to life and brought forth from it grain, and from it they eat.” Holy Quran

The agricultural sector is one of the most important sectors of work, production and increase the national income. The importance of agriculture is highlighted as the basic donation for nutrition resources instead of supply the needs of industries from fundamental materials, that because it is the vast markets for industrial manufactories. The surplus of agricultural production will be the first step in economic development.

The agricultural geography is one of important sectors of human geography. That is to say it is concern with study of relationship between human and land in area of agricultural productions and analyze of natural and human factors which control the distribution of agricultural activities and its patterns and productions levels.



Elnuhoud locality is one of important agricultural localities in West Kordofan State, where there are varieties of agricultural activities as: Traditional rained agriculture and other Cash crops. Therefore it depended on natural factors like: climate, land, self-resources beside many human factors, workers, different agricultural owners, donations, marketing and agricultural policy. Despite of available agricultural potential in the locality, there are hesitating in agricultural productions from one season to another. So this needs an analysis study to discover the geographical factors that effecting this production, and also to determine the role of any factor, so as to reach scientific recommendations to contribute the agricultural production in the locality.

This study is an attempting to bridge a research gap of scientific geographical studies in this subject in analytical way join between human and neutral factors.

Statement of the Problem

The problem is in collapse and hesitating of agricultural production and decrease of perfect using of the land in study area. The core of the problem in the basic question: what is the effect of neutral, human, services upon the sustainability of agricultural production in study area?

1. What is the climate and environmental pressures in fluctuation of rain, unstable of temperature, verities of surface topography, cause a decrease of agricultural production with many farmers?
2. Human and economical sides like: small agricultural farmer's area, depending on local techniques, influence of desertification, cutting trees, excessive grazing.
3. The weakness of agricultural gaudiness, storing, greed of speculators, Price monopoly all this change agricultural activity from main job to be secondary one for many farmers.

Hypotheses of the Study

1. There are statistic varieties between fluctuation of climate elements (temperature and rain) and low soil fertility and decrease of amount agricultural production in the area.
2. There are statistic varieties between small space of possessory areas and local techniques and increase of budgets and delay of agricultural operations.
3. The expand of urban and population and environmental mismanagements (cutting trees, excessive grazing) to decrease of agricultural production and collapse of vegetation cover.
4. The fragility of the marketing infrastructure, monopoly control, weak of modern storing affect negatively on economical income and production sustainability.

Objectives of the Study

The study aims in general to diagnose and analyze geographical obstacles components of agricultural production as following:

1. To evaluate size and effect of natural obstacle (fluctuation of rain, low soil fertility, unstable of temperature and uneven surface) to decrease of agricultural production amount.

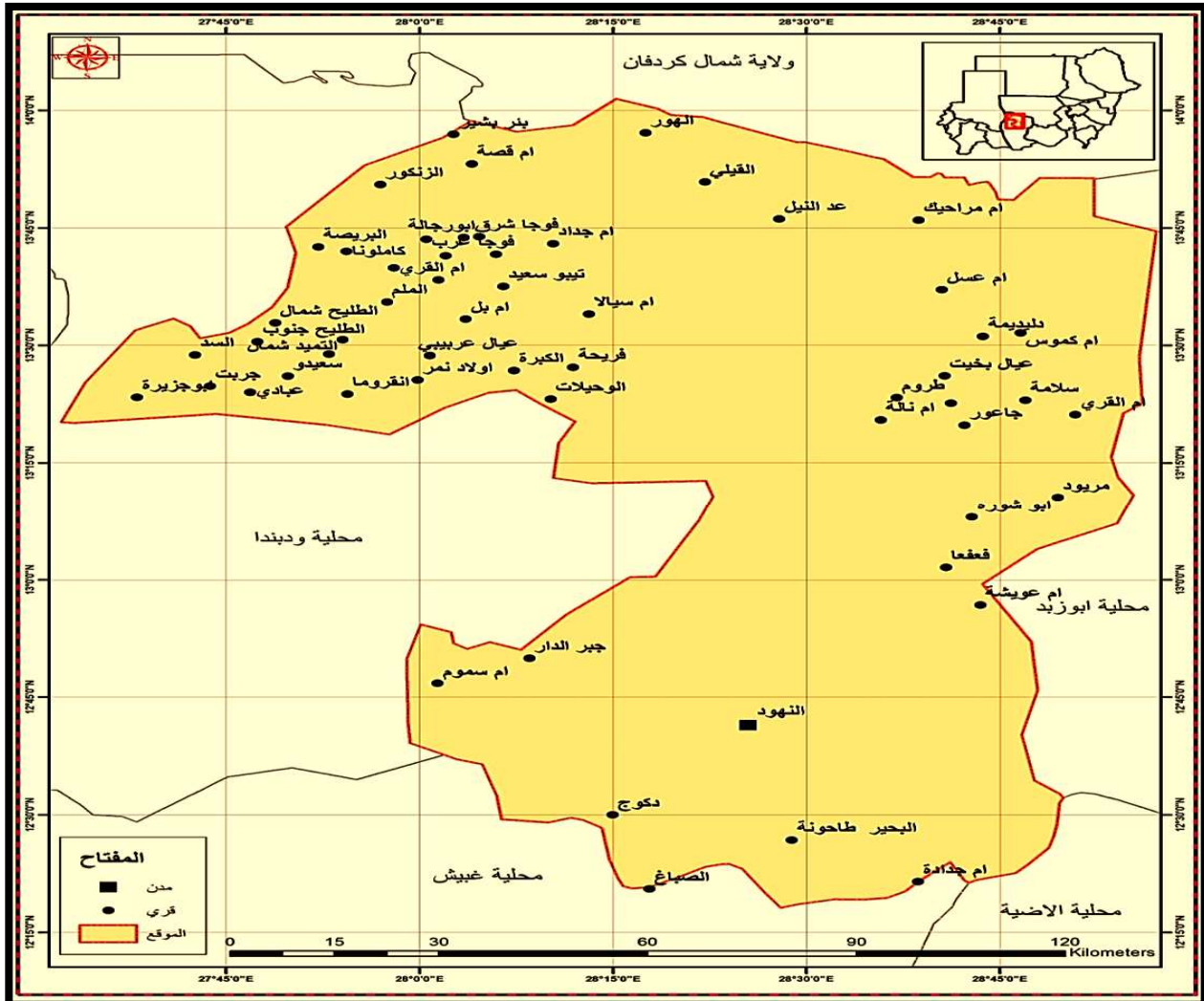


2. to Identify types of the most influence agricultural pests (locust) and evaluate the fighting power in the area.
3. To analyze of marketing, storing, agricultural extension services and put recommendations and geographical application to solve production imbalances and to achieve sustainable agricultural development.

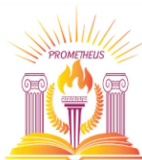
Methodology of the Study

Elnuhoud locality is located in West Kordofan State in "41 41 12" north and "40 25 28" east. From the north the Sodary Locality, from the south Ghbaiesh Locality, from the west Wad banda Locality, from the east there are Bara and Abu Zabad localities. In south east the is South Kordofan State. The total area is 28.41667.571

Map (1) illustrates the geographical area of the study



Source: Sudanese General Survey Authority 2023



Definition of Geographical Agriculture and its Concept

Many geographical, agricultural, economical researchers studied definition that related to their specialist:

Bernard mentioned that **“Geographical Agriculture aims to shed a light upon location changes in agriculture and seeking for its causes”**

In 1964 Reads said that **“Geographical Agriculture means in general concept movement to describe a explain the differences in area in agriculture”**

But the literal definition of the term **“Agriculture”** that it contain of two parts **“agros”** means field and the other **“culture”** means take care of land and tillage so the meaning as general means **“tillage of land”** (alzoka 2000:P 23)

This literal definition does not going with just tillage of land and prepare it for agriculture. The agriculture nowadays goes beyond that in many other activities related to agriculture either direct or indirect. It extended to include: animal husbandry, erase forests and replace by agriculture, and all activities by human beings to supply food for human and animal through control the circumstances.

The agriculture as above means **“all the operations that aims to prepare suitable environment to grow plant that human and animals need** (Haroun 1440h p: 17)

Worth mentioning that UN through FAO **“Food and Agriculture Organization** that includes forest activity, hunting and grazing are including its activities.

In their definition of Geographical Agriculture the researchers mentioned to the influence of natural environment in identify pattern of agriculture and its geographical distribution. But Probabilists say that the human is superior in identifying the sort that will select in natural environment. (Haroun 1440h p: 18)

The Natural Factors that Impact Agricultural Production

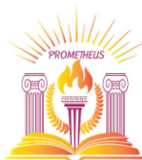
Agricultural production effect by natural factors from one side that because it is phenomenon influenced by other climate circumstance or human. The natural circumstance varies from area to other, that to say any area differs from other. Any area has it own characteristic in environmental circumstance in the area like climate which include other elements of climate in other area. That its production in many new areas gives production like other in original areas.(Elmusaid 2021)

Climate Factors

The climate plays the main role and a big factor that effect in agricultural crops. This factor identifies the where and what crops should be grown in an area. Any crop has specific climate. Some crops can be found in area but other is not. Also the climate impact is differs from crop to other.

The rain by the other hand also is important factor in production, temperature also important factor to other crop. (Hashim 2014).





Human Factors that Impact Agricultural Production

The human factors the most important in agricultural production: way of lives, agricultural rotation, agricultural policy, markets and transportation. (Kathim 2014)

Agricultural Holdings

It is specific area of agricultural land contents of one or many pieces owns by a farmer regardless rent or possess.

The farmer may use it or a part of it to grow different crops. The owner was responsible of the land control and water.

Agricultural holdings show the relationship between human and land, it effect directly in identifying average of each person from area and other pattern of land owners: special own, tribal own, general own government (Abu Ali 2004 p231)

Agricultural Rotation

It is growing crops in specific area for specific duration. So it differs from estate to other according natural environment and human aspects.

The aims of applying agricultural rotation to agricultural collective that eased operation of agricultural crops revises, pest resistance, different diseases and avoid bad traces that come from growing different crops beside others. So organize of growing crops in large area destroy bad traces that come from growing crops in small area. (Alzoka 2000 p: 122)

Agriculture in Sudan

Sudan is one of the large Arabic and African countries in agricultural activities, also it is a reach country of natural resources that make its economical depend on agricultural animal productions. The agriculture is backbone of economic and on it many economical activities. Agriculture is the base of social components that control by anthropological, climate, and nature of land.

Despite of huge agricultural materials in Sudan the development of agricultural sector and achieve from it, it needs more power to use it so as to develop production and development to progress and advancement.

The economic statistic and analysis show that the agricultural sector is on the top in Sudanese economic. In 2002 the agricultural supply is 45.5% from general production. 80% of people depended on agricultural production in their life. 90% of Sudan Export depended on agricultural production.

The agricultural production has a large chances and choices of basic development and investment, Sudan was candid one of three countries to solve the world food problem with Canada and Australia.

In Sudan there are four types of agriculture depended on the way of irrigation and production style: rained agriculture which depended on rain and it covers 25% of total land, irrigation agriculture which depended on mechanical irrigation 25% (River Nile and its branches) this is also divided into: direct irrigation from dams and reservoirs (pumps from river) and flood irrigation as in "Alghash" and mechanical irrigation 21% which use machine in production operation and at last traditional agriculture in plural areas around villages it is about 23 million hectors. It depended on hands tools and local seeds, not use fertilizers so it cause low productions.





Analysis and Discussion of obstacles on Agricultural production in Area of the Study

This study follows complete geographical analysis for results field survey of Obstacles of natural environment that affects the agricultural activities.

The statistical tests show that 95% there are main statistic differences that the main role of natural circumstance directs and identify the agricultural production in the area, 94.1% of Participants agree that there are obstacles.

Firstly: natural obstacles on Agricultural production in Area of the Study

1. Climatic and hydrological features (rain and temperature) hesitation of rain system: the hesitation of rain is the basic obstacle 76.5% that means the lack of organization of seasonal hydrological role. That impact on agricultural production on 72.9% of farmers that due to the relationship between the agriculture and rain directly, and low of water harvesting project

Thermal effects and environmental effort: the opinions go between hesitation of temperature (44.7%) and high degrees (43.5%) in total (88.2%) this variety because to increase in evaporation, it reduced the production (68.2%) out of participants.

2. Soil and morphometric properties (soil and topography of surface) Soil texture and fertility level: in this area there is clay soil (51.8%) then mixed soil (45.9%) regardless the clay soil the area suffer from regressive of fertility as main obstacle (49.4%) Soil disintegration (34.1%) this due to Dredging of water and air and repetition of agriculture without land replacement.

Topography of surface: the uneven and rugged features of the earth's surface have affect (42.4%) on useful of land that is because of obstacle the movement of mechanic operation, which cause to unorganized water distribution.

3. Biological dimension and prevention management (Pests and control methods) pests and biological threatens: the pests are obstacle very dangerous. The locust (37.6%) then beetles and birds (18.8%) the others are (43.5%).

Control methods and administrative intervention: the increase of using modern methods, through Plant Protection Department by using pesticides (69.9%) others (34.1%) using local methods. That means the area needs governmental donation.



Table (1) illustrate important geographical and statistical indicators

Impact on AGR Pro	percentage	Field characteristics	Neutral factor
Decrease of Pro (72.9%)	76.5%	Unstable & Fluctuation	Rain
Decrease of Pro to 68.2%	44. Fluctuation to 43.5%	Fluctuation between low and high	Temperature
Pro low, soil erosion, weak of fertility	prorated variation	Clay soil (51.8%) infertilities (49.4), an uneven surface	Land and surface shape
Combating depended on pesticides & plant Protection Service (69.9%)	37.6% for locust	pest infestation locust beetles and birds	Agricultural pests

Source: field work 2025

It is clear from the study that the area suffers from fragility of natural environment (Fluctuation of rain and weak of fertility), beside that surface of land and pests that caused to decreased of crops to (37.6%) of population. This needs direct entries to improve infrastructure of agriculture and use new techniques.

Secondly: human obstacles that impact on agricultural production

1. Environmental changes and transgression on vegetation cover (environmental collapse) the results show that majority of participants (75.3%) they cutting trees inside the farms. With statistic varieties to cutters: basically it for agricultural needs, (47.1%) to add more free land for agriculture (horizon expand) then using of wood to build houses and for fire (12.8%) which impact directly upon environment which will remove vegetation cover.
2. Agricultural land and changes in using land: directions agricultural area: 41.2% of participants emphases that the agricultural land was decrease while (34.1%) they say it stable and (24.7%) they say it increases. The regressive of agricultural land due to desertification and urban settlement (18.8%) that beside the desertification and Fluctuation of rain (11.8%) the real completion between urban settlement and agricultural expanding.
3. Agricultural outcome and impact factors: the size of agricultural production to worth decrease and collapse, that the (37.6%) of participants agree with decrease of production while (34.1%) they say it is increase this due to natural circumstance (21.2%) and the weak of infrastructure, marketing problems and urban settlement.
4. Guidance and institutional services (technical and support) majority of participants agree with the role of agricultural guidance in increasing of the production. This for giving good seeds (48.2%) bushes supply (27.1%) for improving

production.(78.8%) agree with positive role of plant protection (40.00%) pests infestation (25.4%)

5. Agricultural activities and relationship with grazing: the grazing inside fields (68.2%) agree with it. As usual after harvest (471%) which achieve complementary between grazing and agriculture can controllable by time.
6. Transportation and storing: transporting devices and connected between places (farm and market) most of them depended on trucks (67.1%) animals (18.8%) that means the low of depending on machines transportation, (80.0%) of crops buy in crops markets (51.8%) local markets (42.4%) the selling complete after harvest (45.9%) that the farmers need cash. The village's merchants (35.3%) control and agents (27.1%) of operation of buying. There is lack of direct marketing companies (71.8%) the population agrees with that there not companies.
7. Problems of Storing and Marketing: the main obstacles of marketing in decrease the prices (55.3%) and it monopoly (24.7%) in spite of (69.4%) used to stored their crops. But it is local ways of storing: in side houses (31.8%), using burlap sacks (71.8%) after drying on land immediately (55.3%) this will increase damage of crops.
- 8.

Table (2) the main statistic and geographical indicators

Geo-explanation	percentage	Indicator/phenomenon	Geo-sector
Vegetation cover for expand land	75.3% yes	Cutting trees in farm	Environmental collapse
Urban settlement, desertification, dryness	41.2% Decrease	Regressive of agri land	Using Land
Focusing on good seeds and bushes	87.1% yes	Agre gaudiness role	Statement support
Natural factors weak of infrastructure	37.6% decrease	Size of production	Productivity
The control of middlemen and traders and the absence of companies	Decrease of price (55.3%)	Marketing problems	Economical Geog
Local methods in storing	burlap sacks (71.8%)	Methods of storing	Storing and transportation

Source: field work 2025



From the above table (2) illustrates a statistic geographical clear picture shows the present of agricultural production and environment and responded to governmental supply. According to data from field work 2025; cutting trees (75.3%) this percentage show a great pressure on vegetation cover that due to two reasons: the desire of expand horizon agricultural land to solve the problem of decrease of production, the second for fire woods as source of energy.

The planted areas was decreased (41.2%) is a big percentage directions of using land. This show two different geographical phenomena: urban settlement deducting from agricultural land, collapse of environment due to desertification and dryness, that made many agricultural area out of services.

The regressive of production (37.6%) it is high between production directions, and it is neutral result of environmental collapse, and regressive of agricultural land. This for due to natural factors (rain, dryness) also to weakness of infrastructure (weak of irrigation pipeline, unable to reach services and little amount of machines)

The statistic shows that there is strong state interwoven and continuous in the area. That many farmers agree with the role of agricultural guide (good seeds and bushes) so as to face the collapse and peats so as to increase the production in space instead of horizon expand.

The control of merchants and lack of direct buying or companies it will decrease the farmer's benefits.

The depending on local methods and storing in houses cause damage of crops and lost its qualities before be in markets.

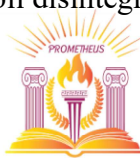
The marketing structure is shown a weak in connection between the areas of production and main distribution places, so it made local farmer ease for agent to cheat him, also and fluctuations of prices.

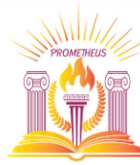
The area needs a place strategic plan to keep between improve of way of cooling, storing and vegetation cover and found marketing groups to stop control of agents.

The study shows that the area environment and economic suffer: that for the expand of population and Ural settlement to decrease agricultural land and cutting trees that will increase of desertification and dryness then will decrease production in crops. In spite of positive role of agricultural corporations (guide and protect) but the weakness point is in ways of storing, control of merchants, low of prices which need to direct inferences from state to build infrastructure for sorting and make ways of marketing to protect environment of agricultural and its Sustainability.

Results

1. Vast majority of participants (94.1%) agree with the notion that there are strong obstacles, natural, environment that affect in productivity movement.
2. Fluctuation of rain is environmental obstacle (76.5%) that shows clear unstable of growing land which decrease the production for (72.9%) of farmers
3. Unstable of temperature between high and very high (38.2%) and decrease of production (68.2%)
4. In spite of superiority of clay land (51.8%) and mixed one (45.9%) but low of fertilities is obstacle (49.4%) beside Soil disintegration (34.1%)



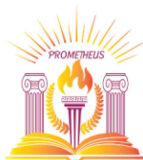


5. Uneven ground surface and topography of the region (42.4%) upon quality of irrigation and field operation.
6. The pests has a role (locust) (37.6%) beetles and birds continuous threats.
7. Farmers depended direct on chemical solutions through Plant Protection Department (65.9%) to fight pests comparing with local ways (34.1%)
8. Increase the activity of agriculture as secondary activity (83.5%) to improve income according to depending on trade and employee.
9. Superiority of small owner and agricultural (1-5 plots) (44.7%) stop agricultural mechanical.
10. The regressive of vegetation cover and grow area (41.2%) cutting trees (75.3%) urban settlement, grazing inside fields (68.2%)
11. Weak of marketing and storing activities, where the agents, villages' merchants, control the crops. Weak of using modern sorting (using burlap) (71.8%).

Recommendations and Suggested Solutions

1. Using rainwater harvesting and build new earthen dams and pools to decrease of desertification impact on rainy season.
2. Widening in using good seeds that resist dry and temperature.
3. Make topographic surveying operations to improve quality of using water.
4. Applying the agricultural rotation and adding Organic fertilizers
5. Enact strict laws to stop population expansion against fertities agricultural land.
6. Organize Pastoral roads and identify time of animals' inference to avoid environment collapse and consistence of soil.
7. Encouraging afforestation and establishing a green belt as windbreaks to protect the soil.
8. Supporting farmers with modern machinery and technologies for the harvesting and collection phase to save effort and time.
9. Activating agricultural extension units and early pest monitoring in coordination with the Plant Protection Department.
10. Encouraging cooperative societies to consolidate small holdings and facilitate mechanization.
11. Establishing modern, refrigerated warehouses and silos reduces storage losses instead of using traditional burlap.
12. Establishing a regional stock exchange and market for crops to break the monopoly and provide fair prices for farmers.
13. Attracting investment companies to enter the field of marketing and agricultural manufacturing of cash crops (beans and sesame).





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