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RESEARCH ARTICLE

THE AGROECOLOGICAL PERFORMANCE OF THE UNION OF KANKELEN MARKET GROUPS AND THE NERICA UNION IN THE PREFECTURE OF FARANAH, REPUBLIC OF GUINEA

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Abstract

To circumscribe the prefecture of Faranah through the agroecological evaluation of some professional agricultural organizations in the context of sustainable development with the fight against climate change and the preservation of biodiversity; For this evaluation of the agroecological performance of the farms of the union of Kankelen market gardening groups (UGMK) and the NERICA union (U.NERICA) in the prefecture of Faranah, in the Republic of Guinea, we chose. It consists of evaluating their performance based on three components (ecological diversity, spatial organization and agricultural practice). This evaluation provides guidance on the agroecological behavior of farmers in market gardening and rice farming in the said locality. This work highlights the combination of fifteen (15) indicators structured in three dimensions cited above and that the judgment reference is based on the maximum agroecological performance score. It is proposed by the Farm Sustainability Indicator (IDEA) method. The results obtained by these unions including an operator workforce of three hundred three (303) for the UGMK and one hundred and ninety-two (192) for the NERICA union, proved appreciable with a score of 65.7% for UGMK and 62.30% for U. NERICA. This is due to the massive participation in training workshops led by their development partner (ISAV, PNAAFA, AgriFARM, National NGO : AGUISA, APIC guinea).

Introduction:-

Guinea, in the context of the fight against food insecurity, continues to increase agricultural production through the excessive use of chemical inputs, which have harmful consequences on human health, but also on the fertility of floors. But is this increase in agricultural production not in line with agroecological performance? Because the search for a sustainability indicator that would be likely to help a transition towards sustainable agricultural and rural development constitutes a strong recommendation from the United Nations Conference on Environment and Development (Rio, 1992). Also in the same context, the French journal of Photogrammetry and Remote Sensing in 2023, seeks to reconcile sustainable agricultural development with the fight against climate change and the

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preservation of biodiversity. To meet these challenges, political, technical and socio-economic decision-makers now have access to information relating to the environment, particularly satellite images and environmental data from these images. This is why in Guinea, the Ministry of Agriculture has relied on French technical expertise cited by Gabriel Jaffrain to develop agroecological zoning across the country aimed at identifying and quantifying current agricultural zones and evaluating agricultural potential. allowing them to obtain mapping of land use and its dynamics over a period of 10 years. It is in this context that Guinea has determined its potential in Arab lands with 6.2 million hectares, which is only 25% exploited. To date after re-evaluation this figure would be 13.7 million hectares according to the Minister of Agriculture and Livestock, despite these potentials the country displays low yields (DSP, 2018).

To this end, in Faranah the agricultural potential to be preserved and used wisely by agricultural stakeholders is 879,423 ha (slope 869,007 ha, plain 8,423 ha, lowland 1993 ha) (R M P D, 2021).

Despite this enormous potential, the agricultural sector suffers from the lack of collective efforts made to achieve performance that respects environmental practices. Based on this hypothesis, the Guinean government launched a solemn appeal to all agricultural populations to form professional agricultural organizations. This is why he promulgated law L014 which applies to all of these professional agricultural organizations to be able to stimulate agricultural development in the country.

In this context, we seek to know in the prefecture of Faranah, the agroecological performance of rice growing and market gardening through the NERICA union and the UGMK union.

Material and Methods:-

Material:-

Presentation of the study area

This study was carried out in the prefecture of Faranah, located 453 km from the capital Conakry, it is the administrative subdivision of the region of Faranah, in Guinea, the capital is the town of Faranah.

The prefecture of Faranah has 299,612 inhabitants (2016 census), a density of 23 inhabitants/km2, transition zone between Middle Guinea and Forest Guinea, is located in the south-eastern part of the Republic of Guinea.

It is between 10° 10’ and 11° 02’ north latitude and 10° 12’ and 10°50’ west longitude with an average attitude of 340 m. The choice of the prefecture was motivated by the fact that it is the source of the Niger River and subsequently by its belonging to an agro-climatic zone favorable to the practice of market gardening across enormous plains and lowlands.

It is limited:

1. To the north by the prefecture of Dabola and part of Kouroussa;
2. To the south by the prefecture of Guéckédou and part of Kissidougou;
3. To the east by the prefecture of Kissidougou and part of the prefecture of Kouroussa;
4. To the west by the prefecture of Mamou and to the Republic of Sierra Leone.

It covers an area of 13,000 km2 with a population of 78,108 inhabitants according to the 2014 census by PLAN GUINEE.

It is made up of ten (10) rural communes plus the urban commune which is recorded in the map of the prefecture, nowadays certain districts are erected as rural communes resulting in a list of sixteen (16) which do not appear first on the administrative map but on the PLAN Guinea health map.

Methods:-

Sampling

To have a representative sample, the number of farms studied in the union is obtained using the nominal approximation of the binominal distribution according to (Serhier,2020) is written with the following formula:

$$\mathbf{n'} = \frac{\mathbf{N \times n}}{\mathbf{N+n}} (1)$$

Or :

n', corresponds to the corrected sample size, N is the finite population size and n is the initial sample size.
The representative sample of the number of farms studied by the groups making up the union is obtained using the normal approximation of the binomial distribution (Dagnelie, 1998) with the following formula:

$$N = \frac{P_i(1-P_i) \times U^2_{1-\frac{\alpha}{2}}}{d^2} \quad (2)$$

We note: N, the number of farmers studied, Pi the proportion of agricultural households, $U^2_{1-\frac{\alpha}{2}}$, the square value of the quantile which is 3.84 for a percentile of 0.95 and the expected margin of error of 5%.

Based on the N values from the exploratory results of the two unions, for the NERICA union 192 members and for the UGMK 303 members who were retained. The sample is distributed in parallel according to the agricultural population targeted by group then by union. We thus retained as a representative sample of 77 members for the NERICA union and 121 members for the UGMK.

The survey of these members of the two agricultural unions was carried out from October 15 to December 25, 2023. covering the following information: main activity, cultivated area, type of labor, inputs used EBE and information relating to the 'environment.

To collect information on agroecology performance, the questionnaire was included.

Characteristics of agroecological performance:
This evaluation of agroecological performance is part of the IDEA method, is a systemic and quantitative approach method which is structured into three components and fifteen indicators making it possible to quantitatively evaluate, for agricultural operations, applications which are sensible to move in the direction of sustainable development. It will take into account the environmental impact of the operator's activities on the territory and natural environments. The analysis of agroecological performance allows us to focus on the natural tendency towards a state as a result of anthropogenic actions.

The evaluation applies to the following parameters. : valorization and respect for natural resources (choice of speculation and systems, quantity of water, irrigation management, chemical inputs, heavy metals and erosion), contribution to the production of local biodiversity (multiplicity of plant crops and management of local ecosystems), reduction of energy dependence (energy production and consumption), reduction of impacts on climate change (reduction of greenhouse gases), manage the potential of soils and eliminate erosion, manage in following the waste.

Ecological diversity is the first component which makes it possible to play on the natural regulation process, favored by agricultural ecosystems. This ecological diversity is assessed by all the indicators that rate the component.

The organization of space: this component presents zones of ecological regulation through the idea of maintaining the natural state of space in order to encourage ecological interactions, while preserving actions in favor of natural heritage. It has a lower weight than the previous one, its value is consequently limited and it materializes participation in voluntary actions.

Agricultural practice constitutes the last component of agroecological performance which is the source of classic agronomic analyzes (polluting pressure from pesticides, apparent balance of nitrogen fertilization and energy dependence) whose evaluation can be carried out without enough difficulty through data available on operations such as stock accounting. This calculation takes into account the presence of nitrate-trapping crops as well as the consideration of agricultural techniques selected favorably for the environment in farm practices.

Assessment of agroecology performance
Agroecological performance is evaluated using fifteen indicators and can be readjusted at a given time, that is to say that of the survey by taking a photograph of the farm looking at its sustainability.

For an individual operation, each of the indicators per component is studied, the aim is to see those which play favorably or unfavorably on the score and identify the point of each component from which we can advance. This result, evaluated over four years, allows us to measure the evolution of a farm.

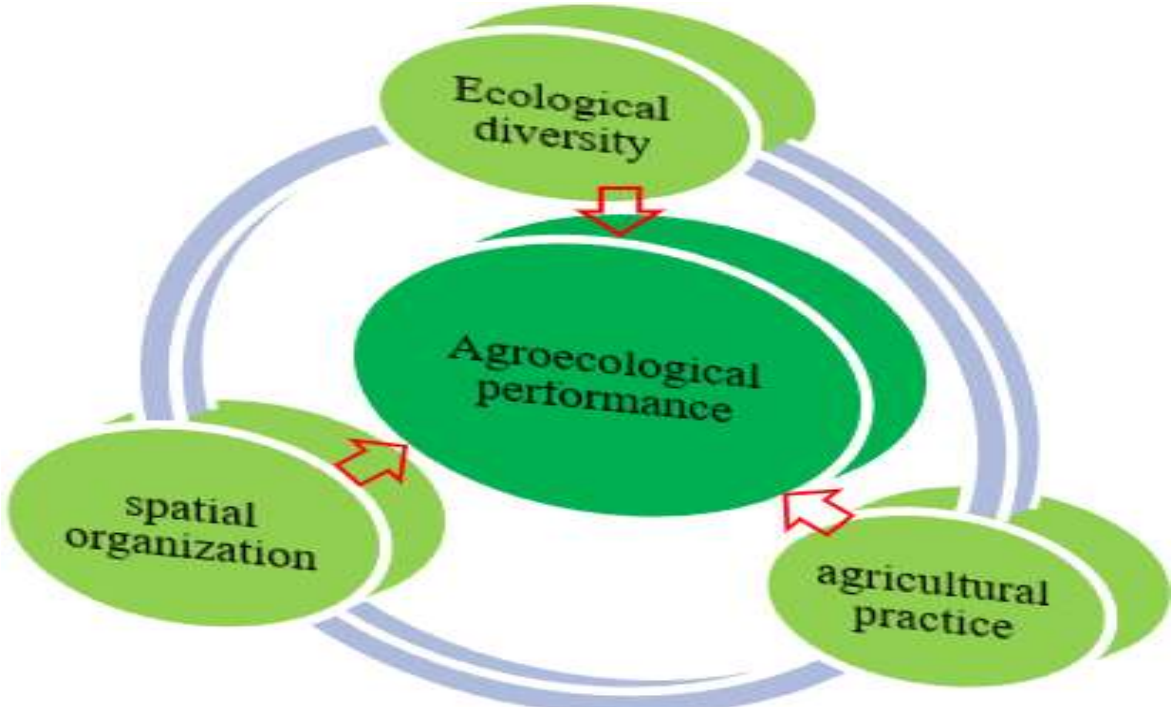

Figure 1:- Assessment of agroecological performance**(CISSE, 2023).**

For a farming group, IDEA makes it possible to characterize certain agricultural production systems, to compare them with each other and to encourage the thinking of certain groups of researchers and farmers, allowing them to find solutions for the development of work and to raise awareness among producers. in the sense of their agroecological performance (Table 1 and 2).

Table 1:- Model for evaluating the agroecological performance of the market gardening union(AHOUANGNINOU 2013).

Component	Indicator	Evaluation method
Ecological diversity: 30 points	Diversity of local cultures: 8 points	3 points per species of vegetable, cited Per additional variety: 1 point; If presence of legumes (peanut, cowpea) in the rotation (1 additional pt) Less than 10% of the rotation: 1 pt; 10% to 20% of the rotation: 2 pts
	Diversity of exotic cultures: 8 points	1 point per species, cited Per additional variety: 1; If presence of legumes (green beans): 1 additional pt
	Associated plant diversity: 2 points	If there are beautification trees Yes: 2 No: 0
	Valorization and conservation of genetic heritage: 5 points	✓ 1 point/species and per regional variety (region of origin); ✓ -3 points/transgenic variety
	Preservation of biodiversity: 7 points:	Organic farming (7 points); Use of organic fertilizers (3 points); Use of chemical fertilizers (- 2 points); Use of natural pesticides (3 points); Use of very toxic chemical pesticides (- 3 points); Use of toxic chemical pesticides (- 2 points); Use of low-toxic chemical pesticides (- 1 point)
Spatial organization: 25 points	Crop rotation: 10 points	Main crop less than 10% of the surface area to be planted: 10 points; Main crop less than 15% of the surface area to be planted: 09 points; Main crop less than 20% of the surface area to be planted: 08 points; Main crop less than 25% of the surface area to be planted: 07 points; Main crop less than 30% of the surface area to be planted: 06 points; Main crop less than 35% of the surface area to be planted: 05 points; Main crop less than 40% of the surface area to be planted: 04 points; Main crop less than 45% of the surface area to be planted: 03 points;

		Main crop less than 50% of the surface area to be planted: 02 points; Main crop greater than 50% of the area allocated: 0 points • Significant presence of a mixed crop within plots: 02 points
	Plot size: 10 points	Plots smaller than: ; 200m²: 1 point; 500m²: 2 points; 1000m²: 3 points; 1500m²: 4 points; 2000m²: 5 points; 2500m²: 6 points; 3000m²: 7 points; 5000m²: 8 points; More than 5000m²: 10 points
	Crop rotation/succession: 5pts	Rotation of 50% of the assolate surface: (5 points); Rotation of 40% of the assolate surface: (4 points); Rotation of 30% of the assolate surface: (3 points); Rotation of 20% of the assolate surface: (2 points); Rotation of 10% of the assolate surface: (1 point); Rotation of less than 10% of the assolate surface: (0 points)
Agricultural practice: 45 points	Fertilization;12 points	Use of poultry droppings (manure): 12 points; Use of plant compost: (6 points); Use of urea in recommended dose: (-1 point); Use of urea in quantities greater than the recommended dose: (-3 points); Use of NPK in recommended dose: (-1 point); Use of NPK in quantities greater than the recommended dose: (-3 points); Use of urea and/or NPK near a watercourse: (-4 points)
	Crop protection: 12 points	Biological control and zero pesticides (12 points); Use of natural pesticides (neem leaves or papaya, etc.) (10 points); Use of biopesticides (10 points); Chemical control (calculation of the Degree of compliance with phytosanitary requirements "DRPP" = Applied dose of chemical pesticides/Approved dose) DRPP =1 (10 points)
	Floor protection: 3 points	Deep plowing technique on 30 to 50% of the cropped area: 1 point; Deep plowing technique on 50 to 80% of the tilled area: 2 points; Deep plowing technique greater than 80% of the tilled area: 3 points; Bare soils less than 30%: 2 points •Strong erosion: -1point; Clearing: -3 points; Use of herbicide and/or nematicide: -3 points
	Water management: 3 points	No irrigation: 3 points; Irrigation on at least 1/3 of the surface area: 1 point; Watercourse samples: 1 point; Use of chemical inputs in operations near watercourses: -2 points; Well: 2 points; Drilling: 1 point
	Energy dependence: 3 points	No: 3 points; Wind turbine, biofuel, biogas: 2 points; Gasoline, diesel, oil, fossil fuels: 0 points
	Chemical residue management: 8 points	No chemicals: 8 points: Storage of products or packaging in stores: 4 points; Storage of products or packaging in the garden: 2 points; Storage of products or packaging in rooms: -2 points; Discharge of packaging into waterways: -2 points; Reuse or recycling of packaging: 2 points; Burial of packaging: -1 point; Burning of packaging: - 2 points.
	Management of organic matter: 4 points	Composting: 4 points; Transfer to other sites: 2 points; Burning: -2 points

Table 2:- Model for evaluating the agroecological performance of the NERICA union**(CISSE, 2023)**

Component	Indicator	Evaluation method
Ecological diversity: 30 points	Diversity of local cultures: 8 points	1 point per variety, per additional variety: 1 point; Less than 10% of the rotation: 1 point; 10% to 20% of the crop rotation: 2 points
	Diversity of exotic cultures: 8 points	1 point per species, cited Per additional variety: 1;
	Associated plant diversity: 2 points	If there are beautification trees Yes: 2 No: 0
	Valorization and conservation of genetic heritage: 5 points	✓ 1 point/species and per regional variety (region of origin); ✓ -3 points/transgenic variety
	Preservation of biodiversity: 7 points:	Organic farming (7 points); Use of organic fertilizers (3 points); Use of chemical fertilizers (– 2 points); Use of very

		toxic chemical pesticides (- 3 points); Use of toxic chemical pesticides (- 2 points); Use of low-toxic chemical pesticides (- 1 point)
Spatial organization: 25 points	Crop rotation: 10 points	Main crop less than 10% of the surface area to be planted: 10 points; Main crop less than 15% of the surface area to be planted: 09 points; Main crop less than 20% of the surface area to be planted: 08 points; Main crop less than 25% of the surface area to be planted: 07 points; Main crop less than 30% of the surface area to be planted: 06 points; Main crop less than 35% of the surface area to be planted: 05 points; Main crop less than 40% of the surface area to be planted: 04 points; Main crop less than 45% of the surface area to be planted: 03 points; Main crop less than 50% of the surface area to be planted: 02 points; Main crop greater than 50% of the area allocated: 0 points • Significant presence of a mixed crop within plots: 02 points.
	Plot size: 10 points	Plots smaller than: 1ha: 1 point; 2ha: 2 points; 3ha: 3 points; 4ha: 4 points; 5ha: 5 points; 6ha: 6 points; 7ha: 7 points; 8ha: 8 points; 9ha: 9 points; More than 10ha: 10 points
	Crop rotation/succession: 5 points	Rotation of 50% of the assolate surface: 5 points; 40% rotation of the assolate surface: 4 points; Rotation of 30% of the assolate surface: 3 points; Rotation of 20% of the assolate surface: 2 points; Rotation of 10% of the assolate surface: 1 point; Rotation of less than 10% of the assolate surface: (0 points)
Agricultural practice: 45 points	Fertilization;12 points	No use of fertilizer: 12 points; Use of urea in recommended dose: (-1 point); Use of urea in quantities greater than the recommended dose: (-3 points); Use of NPK in recommended dose: (-1 point); Use of NPK in quantities greater than the recommended dose: (-3 points); Use of urea and/or NPK near a watercourse: (-4 points)
	Crop protection: 12 points	Weeding: 9 points; selective herbicide: -3 points
	Floor protection: 7 points	Deep plowing technique on 30 to 50% of the tilled area: 3 points; Deep plowing technique on 50 to 80% of the tilled area: 5 points; Deep plowing technique greater than 80% of the tilled area: 7 points; Bare soils less than 30%: 2 points; Strong erosion: -1 point; Clearing: -3 points; Use of herbicide and/or nematicide: -3 points
	Water management: 3 points	No irrigation: 3 points; Irrigation on at least 1/3 of the surface area: 1 point; Watercourse samples: 1 point; Use of chemical inputs in operation near watercourses: -2 points
	Energy dependence: 3 pàts	No: 3 points; Wind turbine, biofuel, biogas: 2 points; Gasoline, diesel, oil, fossil fuels: 0 points
	Chemical residue management: 8pts	No chemicals: 8 points: Storage of products or packaging in stores: 4 points; Storage of products or packaging in the garden: 2 points; Storage of products or packaging in rooms: -2 points; Discharge of packaging into waterways: -2 points; Reuse or recycling of packaging: 2 points; Burial of packaging: -1 point; Burning of packaging: - 2 points.

Results:-

The IDEA method made it possible to evaluate this performance through four components and fifteen indicators.

Evaluation of agroecological performance by component and by group of the union of Kankélén market gardening groups

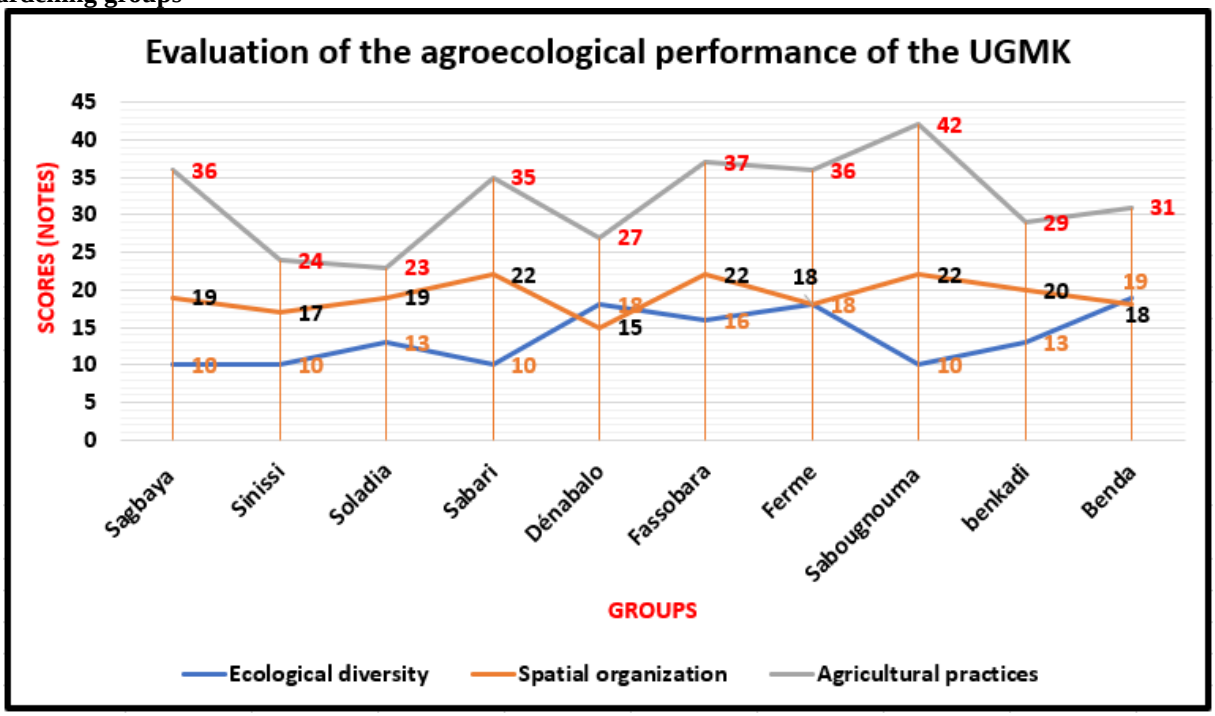

Figure 2:- Evaluation of agroecological performance by component and by grouping of the UGMK.

From this figure, we see that the score obtained by component and by grouping is as follows:
The ecological diversity component is characterized by low scores obtained from 9/10 of the UGMK groups, however the level of performance of the said component is achieved at the level of the Benda group with 51.42% compared to the maximum score of this component. which is justified by the weakness of the results obtained in terms of certain indicators of the said component such as: the diversity of local crops which is rare today because of the demand from customers in market gardening in Faranah as well as plant diversity associated and the preservation of biodiversity which are also low because of the new techniques applied to market gardening fields in this locality, which requires an increasing supply of chemical inputs

While, the scores obtained by this union, at the level of the other two components (spatial organization and agricultural practices) are appreciable because of the enormous agricultural potential that abounds along the Niger River.

The spatial organization component is characterized by very high scores at the level of all groupings with an average score of 19.2/25.

The last component, agricultural practice, presents a high score from all the union's groups with an average of 32/45, explaining excellent sobriety of inputs.

Evaluation of the agroecological performance of the union of Kankélén market gardening groups

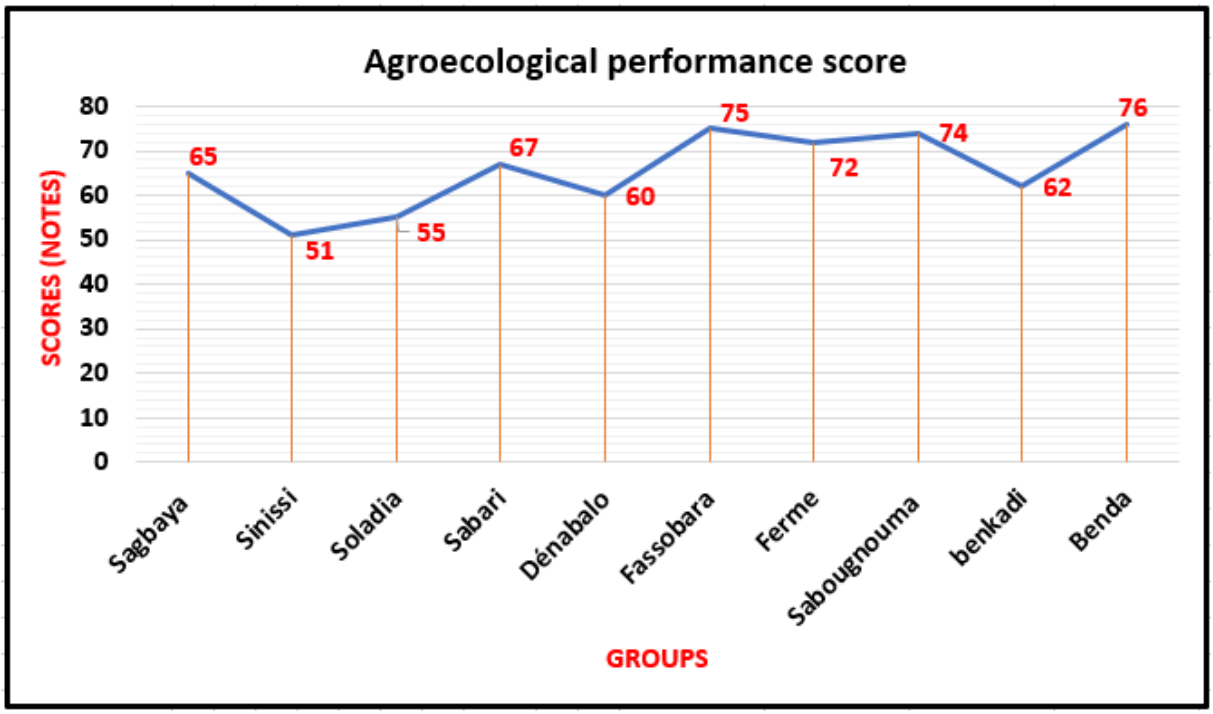

Figure 3:- Evaluation of the overall agroecological performance of the UGMK.

It appears from this figure that all ten (10) groups of the union have reached the level of overall agroecological performance, hence with a final average score of agroecological performance of 65.70/100 and a median of 67, 50/100 for the ten market gardening groups of the UGMK, which is justified by the fact that this union is agroecologically efficient

Assessment of agroecological performance by group and by component of the NERICA union

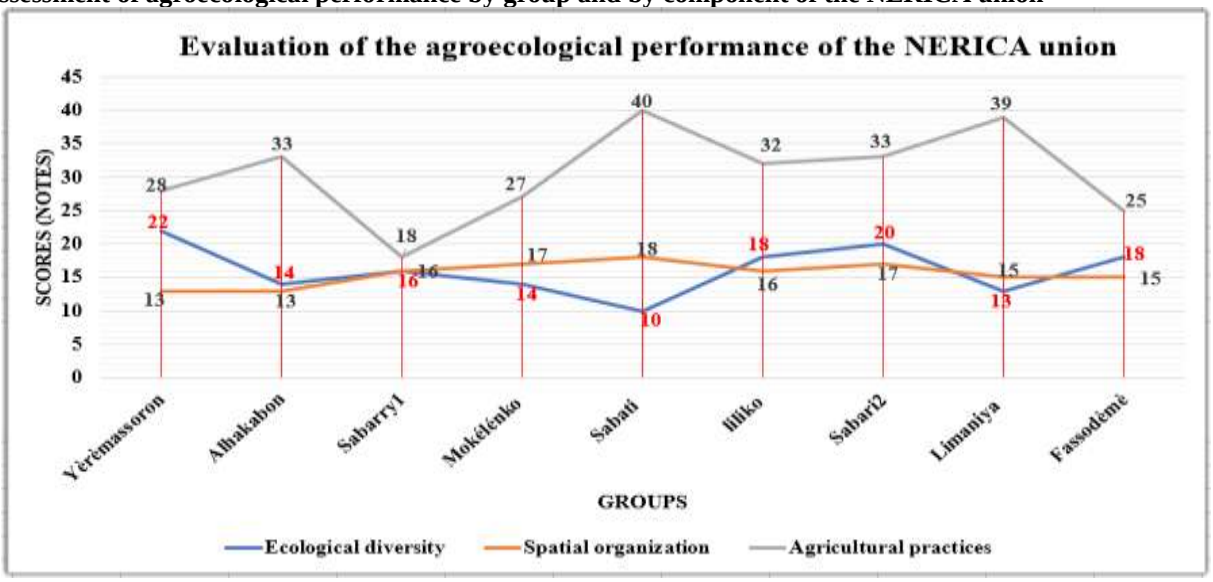

Figure 4:- Evaluation of agroecological performance by component and by grouping of the NERICA union.

• The result in terms of the ecological diversity component is characterized by high scores of 5/9 of the U NERICA groups above 50%, on the other hand the low scores are obtained by 4/9 of the groups of the said union below 50 %.

• The spatial organization component is characterized by very high scores at the level of all groupings with an average score of 19.2/25.
• The last component, agricultural practice, presents a high score from all the union's groups with an average of 32/45, explaining excellent sobriety of inputs.

While, the scores obtained by this union, at the level of the other two components (spatial organization and agricultural practices) are appreciable because of the enormous agricultural potential that abounds along the Niger River.

Evaluation of the agroecological performance of the NERICA union

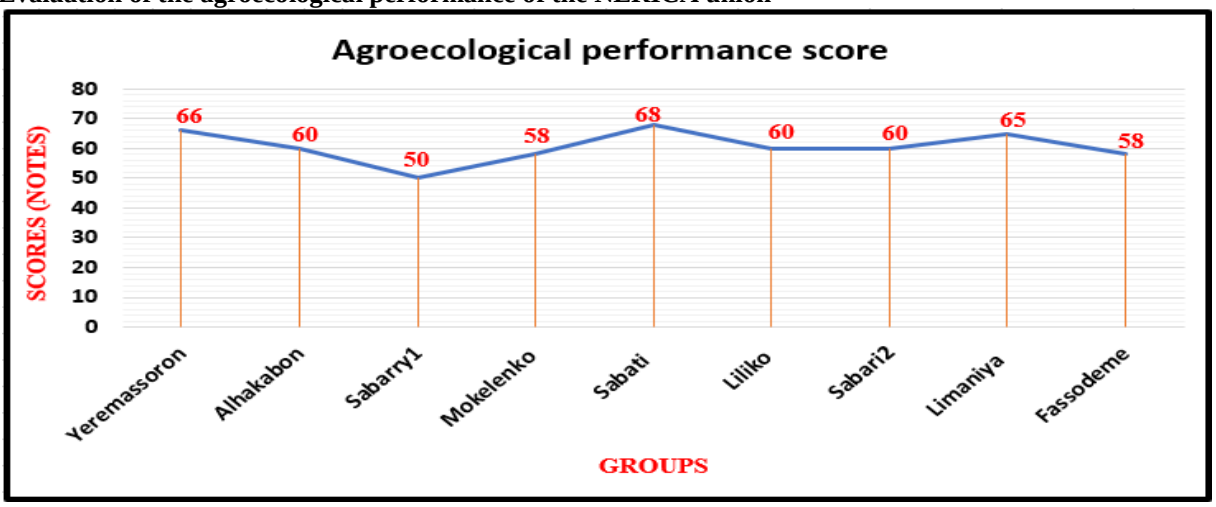

Figure 5:- Evaluation of the indicators of each agroecological component of the NERICA union.

This figure5 shows a final average score for agroecological performance of 62.30/100 and a median of 64.00/100 for the nine rice growing groups of U.NERICA, which justifies the fact that this union is ecologically efficient. .

The evaluation of the agroecological performance of the NERICA union, which focuses on rice cultivation, achieved a convincing result at the level of all three components, but during this evaluation found a shortfall at the level of certain indicators, namely: diversity of local crops, exotic crops, associated plant crops and crop protection technique and the use of chemical pesticides for crop protection which is not encouraged in agroecology. Hence a poor assessment of these indicators. Which also explains the fact that in the prefecture of Faranah, more precisely in this union, many practice monoculture, that is to say repetition of the same variety of rice per campaign and per surface area exploited, therefore less than 10% surface area. rotation or no rotation.

Discussion:-

The majority of market gardeners occupy a small farm and have a lower level of education, while rice farmers generally occupy a large farm and have a high level of education. The areas exploited by market gardening producers of the UGMK union in the Faranah prefecture are small and limited due to the development of these sites carried out by the PNAAFA project. Unlike the NERICA union operating in the same prefecture, its members have variable fields of application due to the enormous agricultural potential along the Niger River; they are sometimes limited in financial resources.

The small area therefore resulted in a lower score for diversity of local and exotic crops in market gardening and rice cultivation. This result is the same as that of (AHOUANGNINOU, C, C A, 2013) in southern Benin.

At the level of these unions (market gardening and rice farming) the main crop generally occupies more than 40% of the exploited areas which explains the low level of cultural diversification, this result is also identical to that of the same author

The result obtained in terms of the indicator (preservation of biodiversity) is low with 2.2/7 for market gardening and 4.6/7 for rice cultivation. To this end, market gardening in the Faranah prefecture has a negative impact on the

preservation of biodiversity given the use of chemical inputs in uncontrolled doses. This result was also demonstrated by (Vlachostergios et al, 2010). For agricultural practice, farmers in this area use overdoses of chemical pesticides, called total herbicide which is used against weeds, this replaces clearing for rice cultivation as well as chemical fertilizers in exaggerated doses for market gardening. Either destroys the nutrient composition of the soil. As a result, water retention in the soil is weakened and nitrogen is easily volatilized. These practices are harmful to human health (Ton al, 2000). The market gardeners of this union in the prefecture of Faranah also use organic fertilizers based on animal excrement, compost and household waste which was the same for (Brock and Foeken, 2006). The use of these organic fertilizers reduces the application of chemical fertilizers which could sustainably improve agroecology. Compared to the dependence on fossil energy is low and almost non-existent, due to the non-practicability of motorized crops by many market gardeners, the majority of these farmers use well water for watering, on the other hand the majority of rice farmers in this union have high fossil energy dependence scores, due to the use of motorized cultivation (ploughing, harvesting and threshing).

Conclusion:-

Faced with the challenges of agroecology, which today constitutes a phenomenon of great concern among international opinion. The vulnerability of the rural world in relation to these issues is an unavoidable reality, which affects the repercussions more clearly (climate change, soil impoverishment, ever-increasing food demand, scarcity of natural resources). This is why these international opinions focus on him, their vigilance and to overcome this reality, collective efforts are engaged in the battle.

In the Republic of Guinea, in the prefecture of Faranah, several projects and programs as well as certain non-governmental organizations have supported the two unions (UGMK and U. NERICA) in this locality in the direction of improving and maintaining agroecological conditions.

To touch on the few improvements in living conditions in agroecology in this prefecture, through these unions, we used the IDEA method, which focuses on the multidimensional approach. This method of evaluating agroecological performance is structured into three components (ecological diversity, spatial organization and agricultural practices) consisting of fifteen (15) indicators for the market gardening union and fourteen (14) for the rice union including the reference of The assessment is based on the maximum performance score. Allowing us to identify the realities of the strength and agroecological vulnerability of the groups of these two unions and opens the vision to a renewal of the analysis of groups (healthy and failing) which is regularly implemented in rural areas.

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