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RESEARCH ARTICLE

EFFECT OF INTERCROPPING SESAME (SESAMUM INDICUM L.) AND COWPEA (VIGNA UNGUICULATA L.) ON THEIR AGRONOMIC PERFORMANCE UNDER RAINFED CONDITIONS IN BAMBEY, SENEGAL

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Abstract

In a context of crop diversification and land scarcity, intercropping remains a viable solution for producers to satisfy their food and income needs. Crop association of sesame with cowpea is not practised in Senegalese farming systems. However, this system could improve land-use efficiency under rain-fed conditions, in the same way as associations of cereals and legumes. The aim of this experimentation is to investigate the effect of intercropping sesame with this traditional crop of Senegal's groundnut-growing region, The study was carried out during the 2021 and 2022 rainy seasons in Bambey, in the north-central part of Senegal's groundnut-growing region. It focuses on a single factor : intercropping, with three (3) treatments : sesame as a single crop (T1), cowpea as a single crop (T2) and a sesame-cowpea intercrop (T3). A randomised complete block design (Fischer blocks) with three (3) replicates is used. The variables measured mainly concerned growth parameters, yields and their components, which were used to calculate biological indicators such as LER, LEC and the percentages of land area saved (%LS). For each variable, the effects of the factor were analysed using analysis of variance (ANOVA) and means were compared using the LSD test at the 5% significance level with RStudio IDE software version 2026.07.1.The results show that, in sesame, HIPC is significantly higher in the intercropping system (102.4 cm) than in the sole-cropping system (89 cm), thereby reducing the number of capsules per plant (74 and 98 respectively) and the average seed weight (4.2 g and 4.4 g respectively). However, the statistical analysis did not reveal any significant differences between sesame yields in the intercropping system (642 kg.ha^{-1}) and those in the pure crop (739 kg.ha^{-1}), nor between the yields of cowpea (908 kg.ha^{-1} and 851.kg ha^{-1} respectively). A LER of 1.94 indicates higher sesame productivity and a 48% of land save.

Intercropping sesame with cowpeas is beneficial and provides a solution and an adaptation strategy to land constraints. However, it would be useful to determine the combinations and spacing between crops with the newly

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approved sesame varieties, which have more promising morphological characteristics and could help to increase sesame productivity.

Introduction:-

Diversification of agricultural activities enables farmers to adapt to market volatility and/or climatic disturbances (Delaunay et al., 2019). The problem of food insecurity (Andres and Lebailly, 2013), combined with the issue of land pressure on arable land, is acutely felt. Diversifying production on the same surface area provides a certain degree of food and financial security. Intercropping is a sustainable strategy for increasing agricultural productivity. This farming system allows for better management of increasingly scarce arable land. In Senegal, almost all fields (95 per cent) are monocultures, meaning they are used to produce a single crop. One of the major obstacles is the lack of farmers' awareness, as they remain largely attached to groundnut monoculture. Sesame (Sesamum indicum L.) is not associated with any other crop (DAPSA, 2023). Intercropping sesame with cowpea (Vigna unguiculata L. Walp) could be a viable option for farmers, as it would improve land-use efficiency.

As an herbaceous annual plant with an upright growth pattern, Sesamum indicum provides additional income. Previously considered a marginal crop limited to southern Senegal, it has become an emerging crop in the groundnut-growing region. It has emerged as an alternative, because of its modest water and fertiliser requirements (Purseglove, 1982), its drought resistance and its effectiveness in combating Striga gesnerioides (Amadou Mounkail et al., 2021), cotton root rot and root nematodes (Langham et al., 2008).

Cowpea, a bean belonging to the Fabaceae family, is the second most widely cultivated legume in Senegal after the groundnut (DAPSA, 2022). It has an essential food role for the Senegalese population, in both urban and rural communities. Its production offers numerous benefits, including nutritional, agronomic, environmental and economic advantages (Gonçalves et al., 2016). Cultivating cowpeas also allows smallholder farmers to mitigate the effects of climate change (Sissokho et al., 2021). It is well established in the regions that make up the groundnut basin (Diourbel, Fatick, Kaolack, Kaffrine, Louga and Thiès). The Louga region produced between 50 and 70 per cent of Senegal's total cowpea production from 2017 to 2022 (Mbengue et al., 2025). Increasingly included in household diets, domestic production is estimated at 152,211 tonnes in 2022, compared with 239,194 tonnes in 2021.

This lack of information and knowledge regarding the use of sesame in intercropping highlights the relevance of this research topic in a context where land scarcity, due to pressure on land resources, is a limiting factor. The overall objective of this experiment is to contribute to the improvement of sustainable agricultural practices in Senegalese production systems, particularly amongst small scale farmers. Specifically, the aim is to study the potential benefits of intercropping sesame with cowpeas. This experiment is to evaluate the performance of sesame and cowpeas when intercropped compared with the corresponding monocultures.

The Louga region produced between 50 and 70 per cent of Senegal's total cowpea production from 2017 to 2022 (Mbengue et al., 2025). As cowpea becomes increasingly integrated into households' food consumption, domestic production is estimated at 152,211 tonnes in 2022 and 239,194 tonnes in 2021. This represents a 36% decrease compared with the previous season and a 19% decrease compared with the five-year average for 2017–2022 (DAPSA, 2023).

It is therefore technically possible to grow sesame alongside cowpeas on the same land. However, no research has yet been carried out into intercropping sesame with other crops in Senegal. In a context where land scarcity, due to pressure on land resources, is a constraining factor, it is important to consider the potential benefits of using this farming system.

The general objective of this experiment is to improve sustainable agricultural practices within Senegal's production systems, particularly amongst smallholder farmers. Specifically, the experiment aims to study the potential benefits of intercropping sesame with cowpea.

Materials and Methods:-

Experimental site:-

The experiment was carried out in the Bambey department, Diourbel region, in the north-central part of the groundnut-growing basin, between latitude 14°41'38 N and longitude 16°28'12 W. The climate is characterised by two seasons : a dry and a rainy seasons. The dry season lasts nine months, from October to June. Bambey is located in the isohyetic zone ranging from 300–600 mm, with a short rainy season lasting from three to four months (mid-June to mid-October). Rainfall is also often unequally distributed, with a peak in August. The cumulative rainfall recorded at the station during the experiments in 2021 and 2022 was 529 mm over 38 days and 533.2 mm over 52 days, respectively. Maximum temperatures ranged from 27.5°C to 41°C, and minimum temperatures ranged from 19.6°C to 29.9°C during these rainy seasons. Relative humidity in the Bambey area varies somewhat, with a minimum ranging from 31% to 66.61%. August and September are characterised by maximum relative humidity ranging from 84.06% to 100% during 2021 and 2022.

Soil:-
The soil at the trial site has the following physical and chemical properties: 86% sand, 6% silt and 8% clay, with a pH of 6.7 ; an organic matter content of 5.9 $g.kg^{-1}$ and a cation exchange capacity (CEC) of 5.3 $mol.kg^{-1}$ (Trail et al., 2016).

Vegetation:-
The vegetation in the area is characterised by a wooded steppe. The main species found there are : Azadirachta indica, Adansonia digitata, Tamarindus indica, Faidherbia albida, Acacia raddiana, Balanites aegyptiaca and Ziziphus mauritiana. The shrub layer consists mainly of Guiera senegalensis, Combretum micranthum, Euphorbia balsamifera and Acacia adansonia. The herbaceous layer is very sparse, with species such as Cenchrus biflorus, Zornia glochidiata and Cassia obtusifolia, in addition to Cyperaceae (Fall, 2005).

Plant material:-
The experiments were carried out on two (02) species, sesame and cowpea, whose characteristics are set out in Table 1.The varieties used are currently the most widely promoted and have been in use for over ten years. Certified seeds (with a varietal purity of 98 per cent and a germination rate of over 90 per cent) are provided by the seed production unit of the National Centre for Agricultural Research (CNRA) in Bambey.

Experimental design:-
A randomised complete-block design (Fischer blocks), based on a treatment assignment, was used over two years (2021 and 2022). It consists of three (3) replicates, due to the limited area of the experimental site. The crop combination is the single factor, with three (3) treatments : sesame as a sole crop (T1), cowpea as a sole crop (T2) and a sesame–cowpea association (T3). Sesame and cowpea are sown as sole crops and in combination (intercropping). The experimental unit consists of a 9 m² (3 m × 3 m) plot. The plots are spaced 1 m apart and the replicates 1.5 m apart. The replicates and plots, surrounded by a 1.5 m wide strip, are arranged over a total area of 210 m² (Figure 1). The plot of sesame grown as a pure crop consisted of 5 rows, each with 9 planting pockets spaced 0.6 m×0.3 m from each other (i.e. 45 plants, corresponding to a density of 50,000 $plants.ha^{-1}$) (Figure 2). The pure cowpea plot has 9 rows, each with 9 seed holes sown at a spacing of 0.3 m × 0.3 m (i.e. 81 plants, corresponding to a density of 90,000 plants per hectare) (Figure 3). The intercropped plot contains 5 rows of sesame and 4 rows of cowpea in between (Figure 4).

Crop management:-
Crops are managed in accordance with the technical guidelines (from sowing to harvest) recommended for each one. It covers, in particular, soil preparation (seedbed), seed treatment, sowing, thinning, maintenance and plant protection, harvesting, drying, threshing and storage.

- Sesame : 5 to 10 seeds are sown per hole and weeding 15 days after emergence, leaving 2 plants per hole ; a dose of 80 $kg.ha^{-1}$ of NPK 6-20-10 fertiliser and 50 $kg.ha^{-1}$ of urea are applied after weeding (Diatta *et al*., 2013) ;
- Cowpea : 2 seeds are sown per hole and a dose of 150 kg.ha-1 of NPK 6-20-10 fertiliser, equivalent to 135 g per basic plot, is applied from weeding onwards, i.e. 15 days after emergence.

The first weeding takes place at the same time.

- **Crop protection**

To control insects and pests, an insecticide treatment (DELTA-TRIN 25EC, containing the active ingredient deltamethrin (25 g/l)) was applied to the sesame and cowpea crops at a rate of 1 L/ha. A preventative treatment with the fungicide Essem 80% WG was carried out at a rate of 5 kg/ha.
To properly protect the crops from rodents and the wind, the entire site was enclosed with a windbreak net.

- Harvest

The cowpea harvest occurred at 60 days after sowing (DAS). The sesame harvest occurred at 103 DAS. In each plot, three middle plants were harvested separately for thousand-seed weight (TSW) measurements. The entire plot was then harvested to assess yield.

- Drying, threshing and screening

After harvesting, the sesame plants were dried in the shade for 15 days to allow their pods to open. The seeds were then separated from the stems and pods or husks, before being cleaned to remove any remaining impurities.

Variables measurements:-

Measurements of individual variables are carried out at random on plants located in the three central rows of each plot, thus avoiding the outer rows and pockets.

Yields are calculated based on the total area of each plots, considering their small size.

Sesame measurements:-

- Plant height : measured regularly every week, from the 35th to the 83rd day after sowing (DAS).
- Height of insertion of the first capsule (HIFC) : this measurement is taken at maturity, starting from the collar to the point of insertion of the first capsule. The lower it is, the more likely the plant is to produce capsules.
- Number of capsules (NC) per plant: the count is carried out at physiological maturity.
- Thousand-grain weight (TGW): after the capsules have been dried and threshed, three samples of 1,000 grains are weighed for each plot.

Measurements for cowpea:-

Only yields per hectare are determined.

Yields and biological performance indicators:-

- **Yields** : they are calculated using formula 1, based on the weight (g) of the seeds harvested from the total area of each plot:

Yield (kg ha^{-1}) = [(Seed weight (g) : 1,000) / (Plot area : 10,000)] (1)

In mixed cropping, the yield of the secondary crop (occupying half the plot) is doubled to obtain its actual yield per unit area.

- Harvest Index (HI): for groundnuts, HI indicates the ratio of seed yield to haulm yield. It is calculated using the formula 2:

HI (%) = (Seed yield / Biological yield) × 100 (2)

- Land Equivalent Ratio (LER) : the comparison of the performance of cropping systems was carried out on the basis of the Land Equivalent Ratio (LER). The LER is defined as the sum of the partial LERs (yield of species A in a mixture / yield of species A in a pure crop). The LER is interpreted as the area of pure crop required to achieve the same production (same quantity and same proportion) as one hectare of a mixture (Willey, 1985). When the total LER is greater than 1, this means that the mixture has made better use of resources than the pure crops. If the LER is less than 1, the pure crop is more beneficial than the crop mixture. The study of partial LERs (LERp) is another way of analysing the behaviour of species.
- Land Equivalent Coefficient (LEC) : this is the product of the LER indexes for crop (i) and crop (j) and can therefore be regarded as a measure of association or interaction in terms of the strength of the relationship. It helps to determine the biological efficiency of the cropping system in terms of crop compatibility, as it effectively measures the interaction between crops, which is defined as a minimum productivity coefficient (PC) greater than 25 per cent. As indicated by Adetiloyeet al. (1983), cited by Idoko et al. (2018), LEC is determined using the formula 3

LEC = (Yij/Yii) x (Yji/Yjj) (3)

When LEC is less than or equal to 0.25, the combination is not beneficial. There is inhibition or competition. When LEC is between 0.25 and 1, the combination is beneficial. There is complementarity between the two crops.

- Aggressivity (Agg): it's an important tool for determining a crop's competitive ability when grown in combination with another crop. An aggressivity value of zero indicates that the constituent crops are equally competitive. If both crops have the same numerical value, the sign for the dominant species will be positive and that for the dominated species negative. The higher the numeric value, the greater the differences in competitive ability and the greater the differences between actual and expected yields. The competitive ability value has been calculated using equations 4 and 5 provided by Ghosh et al. (2006), as cited by Idoko et al. (2018) :

Agg. crop (i) = [Yij / (Yii × Zij)] – [Yji / (Yjj × Zji)] (4)

Agg. crop (j) = [Yji / (Yjj × Zji)] – [Yij / (Yii × Zij)] (5)

- Percentage land saved (% LS): the percentage of land saved indicates the amount of land saved by intercropping compared to monocropping. This was calculated as described by Willey (1985), cited by Idoko et al. (2018), using formula 6 :

% LS = [100 – 1/LER × 100] (6)

Statistical analysis:-

With RStudio 2026.07.1 software version, analysis of variance (ANOVA) was used to measure, for each variable, the effects of treatments, years and replicates, as well as the interaction between years and treatments. Effect sizes were also estimated. Mean differences were tested using the LSD test at a 5 per cent significance level.
Tests for normality and homogeneity were carried out.

Results:-

- Summary:-

The tables below show the global results of the statistical analysis of the variables measured for sesame and cowpea. They concern the results for each year and the averages for the two years of the experiment. The variables for sesame relate to the height at which the first pod appears (HIPC), the number of pods per plant and the weight of 1,000 seeds.As the replicates were homogeneous, these differences are due to the treatment effect, which is the largest factor(Table 2). These show significant differences ($P<0.05$; $\alpha=5\%$) between treatments when the results are considered on an annual basis and when the average of the two years of trials is considered (Table 3).

- **Change in sesame plant height:-**

Intercop significantly reduced sesame plant height between the 42nd and 62nd jas ($P<0.01$, $\alpha=0.05$) (Figure 5).
The differenceheight does not become apparent until the 42nd day. After the 62nd day, the difference becomes less pronounced over the final 30 days of the cycle.

- **Height of the first pod (HFP)**

Crop association had overall, a significant effect on the height at which the first pod appears ($P<0.05$; $\alpha=0.05$) over the two years of the experiment. The first pod appearshigher in association compared with sole crop (Figure 6).

- **Number of capsules per plant of sesame:-**

Pods production per plant is significantly higher ($P<0.05$) in the single crop than in the association (Figure 7).

- **Yields**

The yield of sesame in a single crop is equivalent to that in a dual crop.
The yield of cowpea in a dual crop maintained the same level as in a single crop.

- **Competitivityandproductivity:-**

LER of 1.94 indicates higher productivity and a reduction in land use of 48.32 p. cent. In this combination, cowpea proved to be more aggressive than sesame over the two-year trial period (+1.3 and +1.2 respectively) and developed greater competitive ability (CR = 0.6). Cowpea showed a very high complementarity with sesame (i.e. LEC=0.9) (Table 4).

Table 1. Characteristics of the species

Species	Variety	Type / Origin	Provenance	Seed color	Growth cycle (days)	Performance at the research station
Sesame	32-15	Indéhiscent/ Registered in Sénégal /Origin Burkina	CNRA Bambey	Creamy white to yellow	90	1,5 t.ha^{-1}
Niébé	Melakh	Early-maturing, indeterminate growth	CNRA Bambey	White, with a light brown eye	56	1 t.ha^{-1} Weight of 100 seeds : 19 g

Table 2. Analysis of variance of sesame

		HFP (cm)			Number of pods per plant			Weight of 1,000 seeds (gr)			Yields (kg.ha-1)		
Origin of variation	ddl	F	Pr(>F)	Ƞ2	F	Pr(>F)	Ƞ2	F	Pr(>F)	Ƞ2	F	Pr(>F)	Ƞ2
Replicate	2	1,276	0,29518	9%	4,315	0,00983	24%	2,389	0,0827	15%	0.218	0.8814	7%
Treatment	1	8,792	0,00503	18%	15,987	0,00026	28%	8,224	0,0065	17%	3.513	0.0936	28%
Years	1	6,259	0,01644	13%	10,032	0,0029	20%	206,846	<2e-16	83%	3.402	0.0982	27%
Treatment: Years	1	3,366	0,07382	8%	0,034	0,85499	0,1%	2,111	0,1539	5%	0.063	0.8076	1%

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Ƞ2 : size of effect (1-5% small size effect ; 6-13% : medium size effect ; ≥ 14% : large size effect)

Table 3. Sesame variables

	HFP (cm)			Number of pods per plant			Weight of 1,000 seeds (gr)			Yields (kg.ha-1)		
	2021	2022	Aver.	2021	2022	Aver.	2021	2022	Aver	2021	2022	Aver.
T1 (sole crop)	79,3 a	98,8 a	89 a	89 a	107 a	98 a	3,7 b	4,7 a	4,4 a	685 a	793 a	739 a
T3 (intercrop)	100,9 b	103,9 a	102,4 b	63 b	84 b	74 b	3,8 b	5,0 b	4,2 b	601 a	683 a	642 a
Pr>traitement	0,017	0,179	0,006	0,001	0,008	0,0001	0,16	0,013	0,002	0,313	0,162	0,177
Signification	*	NS	**	**	**	***	NS	*	**	NS	NS	NS

For the same column, values followed by the same letter are not significantly different at the 5%. NS: not significant. * significant, ** highly significant, *** very highly significant.

Table 4. Analysis of variance of cowpea

		Weight of 100 seeds			Yields (kg,ha-1)		
Origin of variation	ddl	F	Pr(>F)	Ƞ2	F	Pr(>F)	Ƞ2
Replicate	2	1	0,43629	25%	0,582	0,641 ns	16%
Treatment	1	1,599	0,237792	15%	0,776	0,401 ns	8%
Years	1	42,938	0,000105	83%	1,514	0,250 ns	14%
Treatment: Years	1	0,013	0,911001	0,15%	0,188	0,675 ns	2%

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Ƞ2 : size of effect (1-5% small size effect ; 6-13% : medium size effect ; ≥ 14% : large size effect)

Table 5. Cowpea variables

	Weight of 100 seeds (gr)			Yields (kg.ha-1)		
	2021	2022	Average	2021	2022	Average
T1 (sole crop)	17,5 a	19,8 a	18,7 a	877 a	825 a	851 a
T3 (ntercrop)	17,0 a	19,4 a	18,2 a	962 a	854 a	908 a
Pr> F (traitement)	0,495	0,239	0,195	0,393	0,770	0,557
Signification	NS	NS	NS	NS	NS	NS

For the same column, values followed by the same letter are not significantly different at the 5%. NS: not significant.

Tableau 6. Biological indexes of sesame and cowpea

		Yield (kg.ha^{-1})			Land équivalent ratio (LER)		Land équivalentc oëf (LEC)		Competitive ratio (CR)		Aggressivity		% Land save	
	Treatment	**2021**	**2022**	Z	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**
Sesame	T1 (Yii)	685	793	1	0,88	0,86	-	-	0,4	0,4	-1,3	-1,2	-	-
	T3 (Yij)	601	683											
Cowpea	T2 (Yjj)	877	825	0,5	1,10	1,04	-	-	0,6	0,6	1,3	1,2	-	-
	T3 (Yji)	962	854											
Total					1,97	1,90	0,9	0,89					49,36	47,28
Average					1,94		0,9						48,32	

Z : proportion. Y : yield. ii et jj: sole crop. ij et ji : intercrop.

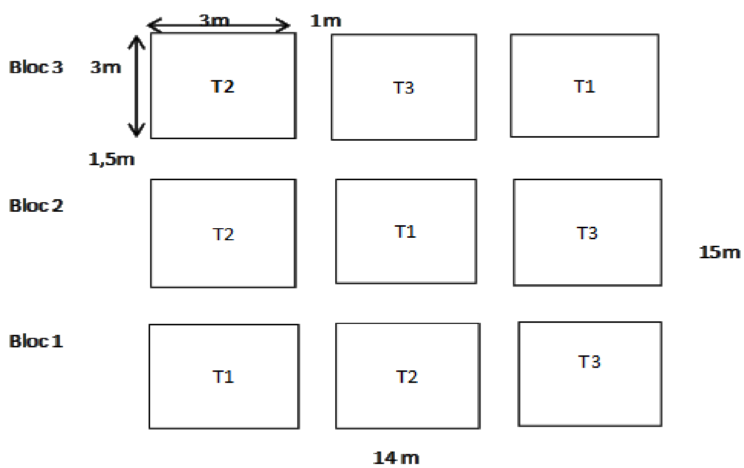


Figure 1. Diagram of the experimental device for cowpea and sesame

Legend : T1 : pure sesame plot, T2 : pure cowpea plot, T3 : cowpea and sesame intercrop.

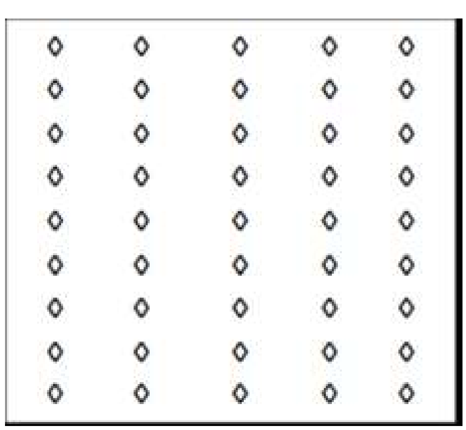


Figure2. Diagram of a basic plot of sesame sole crop

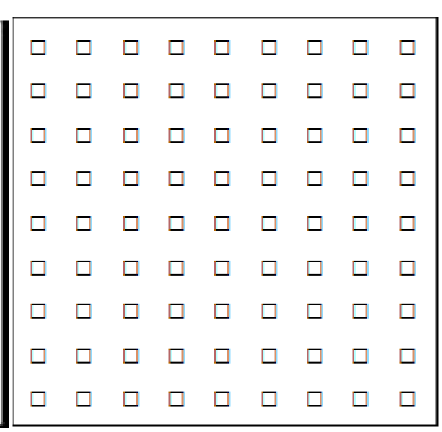


Figure3. Diagram of a basic plot of cowpea sole crop

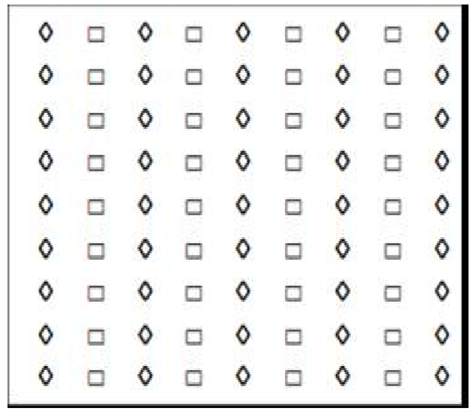
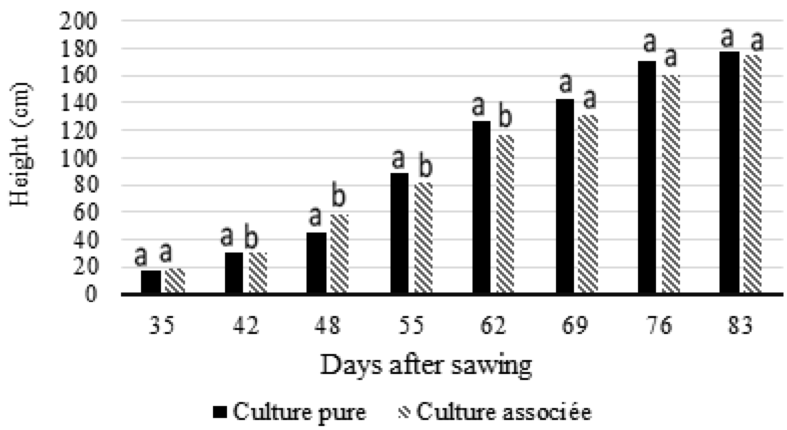


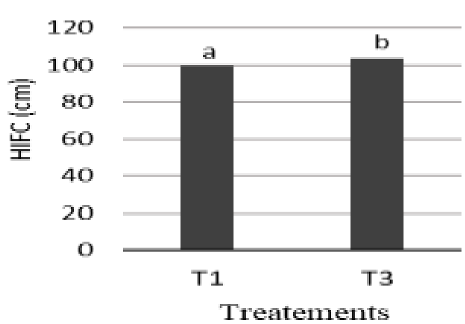
Figure 4. Diagram of a basic plot with of sesame and cowpea intercrop

◊ Sesame line □ Cowpea line



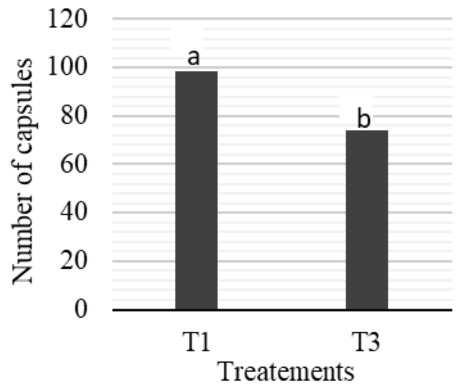
Values followed by the same letter are not significantly different at 5%.

Figure 5. Change in sesame plant height



Values that are not followed by the same letter are significantly different at the 5% significance level.

Figure 6. Height of insertion of the first capsule



Values that are not followed by the same letter are significantly different at the 5% significance level

Figure 7. Number of capsules per plant of sesame

Discussion:-

Intercrop with cowpea slows down the growth of sesame. Sesame is susceptible to stress between the 42nd and 62nd jas. This period corresponds to the period of accelerated growth. This fast growth increases the height of insertion of the first capsule (HIFC) and reduces the number of capsules, but without significantly affecting yield. Diatta et al. (2013) found, for the same variety, an acceleration in sesame growth between the 36th and 48th day, where the treatment applied had a significant effect. When Cowpea crops reach the end of their 60-day cycle, the sesame grown in association with them is no longer subject to the stress caused by the presence of the cowpea. The difference in height compared with sesame grown as a single crop will disappear during the final 30 days of the cycle.

The 32-15 sesame variety has an erect, single-stemmed growth pattern, reaching 180 cm in height, and is moderately branched. This growth structure allows light to reach the surface between the crop lines. The cowpea, which is grown between the lines, being a low-growing crop, benefits fully from this light for photosynthesis. Cowpea is a low-growing crop and the variety used (Melakh) is indeterminate in growth. Its creeping growth habit gives it a wide spread and good ground cover. The structure of its plant cover helps to retain soil moisture, which benefits the sesame grown in association with it during long dry spells. This is confirmed by Sanna et al. (2022), who found that these cropping systems contribute to higher cereal yields, regardless of the growth habit of the associated legume.he root system of sesame is mixed and comprises a taproot and superficial roots. The taproot can grow to a length of up to 90 cm when the plant is under water stress (Sène et al., 2018).

In comparison, Bindhu et al. (2014) found that intercropping considerably reduced the specific weight and yield of sesame compared with sole cropping. Although the statistical analysis indicates no significant difference in yields between the two systems, a LER of 1.94 reveals higher productivity and a land saving of close to half (48 p. cent), similar to the combination of millet and mungbean reported by Trail et al. (2016) with a LER of 1.95. An overall LER greater than 1 (1.94) indicates that intercropping offers an advantage over single-crop systems in terms of the efficient use of environmental resources for plant growth. A total LER was obtained for sesame and cowpea, suggesting that 48 per cent of additional area would be required for a single-crop system to match the yield of an intercropping system. Furthermore, the observed LER value greater than 1 revealed that interspecific interaction or complementarity outweighed competition, meaning that intercropping resulted in greater efficiency in resource use.
Analysis of the LEC parameter – which is the product of the sesame LER and cowpea LER indexes – shows that the intercropping of sesame and cowpea is more advantageous than sesame or cowpea grown as a single crop, with an LEC index greater than 0.25. These results are consistent with those obtained by Salvator Kaboneka et al. (2020) in a maize–bean intercropping system with an LEC of 0.32. Similar studies conducted by Idoko, J.A. et al. (2018) in Nigeria, involving a maize–cowpea intercropping system with different varieties, yielded the same results, with Land Equivalent Coefficients (LEC) exceeding 25 per cent across the different varieties. This further demonstrates the beneficial effect of cereal–legume intercropping.TheResults show a higher CR for cowpea (0.6) than for sesame (0.4). This indicates that sesame proved to be more competitive.Cowpea can yield the equivalent of 0.9 ha within a 1 ha plot of sesame.

Conclusion:-

The study consisted of evaluating the performance of sesame and cowpea grown in combination, compared with the corresponding monocultures. The experiment was carried out on a small dedicated plot, under rain-fed conditions without supplementary irrigation, to replicate current farming practices. It was limited solely to assessing the agronomic performance of the crops, without an economic analysis of the system.The intercropping of sesame with cowpea provides a solution and an adaptation strategy to the constraints associated with population growth and land pressure. This system could therefore improve the efficiency of land use under rain-fed conditions. The objective is not to increase the yield of individual crops, but to generate additional production on land that is currently left unused in monoculture. It could be beneficial to farmers by enabling them to save 48% of land without affecting yields. This is achieved thanks to the cowpea's aggressiveness and high competitive capacity.

By keeping the same sowing pattern for sesame as in monoculture, intercropping provides the same level of yield for both crops. However, this experiment should be repeated with the newly registered sesame varieties, which have more interesting morphological characteristics and could help to increase sesame productivity.

With short-cycle cowpea varieties such as Mélakh (56 days), this cropping system provides an early harvest. This provides smallholders with pods for food, foliage for their livestock and an income during the lean season.

Looking ahead, the following steps should be taken:

- Repeat this trial with the new sesame varieties recently approved in Senegal, which have more favourable morphological characteristics and could further improve land-use efficiency;
- Investigate the combinations or spacing arrangements that yield the best results for both cowpeas and sesame.
- Investigate the impact of such a system on soil resource mobilisation and soil nutrient dynamics;
- Continue the trial in real-world farming conditions, incorporating an economic analysis that would highlight gross income, the cost-benefit ratio and labour requirements.

The results would thus meet the objectives of the project for the sustainable development of the sesame sector and the strengthening of climate resilience in Senegal, and would benefit the National Federation of Sesame Producers.

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