Cultivation trial of *Pleurotuseous* and *Pleurotusostreatus*mushrooms on ricestraw (*Oryza sativa* L.) in Daloa (Côte d'Ivoire)

ABSTRACT

In Côte d'Ivoire, rice growing plays an important nutritional and economic role. However, rice fields also produce huge quantities of waste (rice straw) which is often not used or used very little and in some cases burnt; yet the valorisation of this agricultural waste can increase profitability. It is in this context that this study used *P. eous* and *P. ostreatus*, two edible mushroom, to bio-delignify rice straw and produce edible carpophores. To this end, the stems and leaves of oriza sp were sun-dried for a fortnight and cut into pieces (2-3cm). Agricultural lime and rice bran were added in varying proportions (1% = agricultural lime; 0-15% = rice bran) to obtain several formulations. The substrates were moistened and packaged in heat-resistant bags. The various substrates were then sterilised and inoculated with spawn from *P. eous* and *P. ostreatus* semis. The results showed that the mycelial filament of *P. eous* was observed three (3) days after inoculation. On the other hand, there were three dates (3rd, 9th and 21st day) of appearance of the mycelial front in *P. ostreatus*. The incubation period for *P. ostreatus* ranged from 51 to 57 days, while that for *P. eous* was 52 days. The addition of rice bran in increasing doses reduced the colonisation rate of both species of fungus. The lowest values of biological efficiency were obtained by growing *P. eous*. They ranged from 0% (F4) to 6% (F3). In the case of *P. eous*, the addition of rice bran in increasing doses increased the carpophore yield. But beyond 10%, the yield became zero. In the case of *P. ostreatus*, the yield became low when rice bran was added in increasing doses. This study confirms that rice field waste (rice straw) can be a raw material for the production of edible mushrooms. These results should be disseminated to the general public in order to increase the profitability of rice growers.

Comment [M1]: State in detail, various Treatment(Formulation). What design did you use for your research. How many times were the Treatment(formulation) replicated ?

Comment [M2]: State the statistical software used in the study and what you Tested at what level of probabillity.

Comment [M3]: Please rephrase, is not clear. If *P. eous* was observerd 3 days after inoculation, why is day 3 still important in *P. ostreatus*.

Comment [M4]: Effect comment 1 for understanding of these.

Keywords: *Pleurotus eous*, *P. ostreatus*, rice straw, substrate, carpophores, edible mushroom, biological efficiency

1. Introduction

In sub-SaharanAfrica, people'sfoodneeds are far frombeing met despite the efforts made in the livestock and agriculture sectors[1]. To meetthesedemands, agriculture and foodsystemswill have to adapt to the negativeeffects of climate change and become more resilient, productive and sustainable. This is the onlyway to guarantee the well-being of ecosystems and rural populations, whilereducinggreenhousegasemissions[2]. Everyyear, people getrid of all kinds of agricultural waste. Rubbishaccumulated over weeks and months ends up decomposing on the spot, a source of disease[3]. In Côte d'Ivoire, for example, severalcropsproduce bio-waste, particularlyrice. Côte d'Ivoire is the second largestproducer of paddy rice in the UEMOA (West AfricanEconomic and Monetary Union), with more than 700,000 tonnes, and the thirdlargestproducer in the ECOWAS (Economic Community of West African States) region[4]. This production isaccompanied by agricultural waste. Somestrawisleft in the ricefieldafterharvesting; someisleft to decompose, whileothers are burnt. This producessmoke, whichcontributes to the greenhouseeffect. Very little of thisstrawisused to maketraditionalmattresses. The capacity to use theseresiduesislimited[5]. It istherefore essential to introduce effective methods for recoveringtheseresidues and transformingthemintootherusefulproducts[6]. The development of new cropssuch as ediblemushrooms can improve the quality of people'sdiets and reduceunemployment and poverty[7]. In soilless cultivation, the fungus extractsnutrientsfrom the substrate (grasses, wood and agricultural waste) throughitsmycelium to obtain the substances itneeds for itsdevelopment[8] & [9].Mushroom cultivation islinked to the transformation of agricultural

Comment [M5]: Proofread, use shift key to separate text.

Comment [M6]: See comment 5

and agro-industrialwasteintofood of high nutritional value. This metaboliccapacity of mushroomsisachievedthroughmicrobiologicalprocesseswhich, to achievetheirgreatesteconomicvariability, must becontrolled by optimal physical, chemical, environmental and technicalprocesses/conditions[10]. Yetthis cultivation islittlepractised and this aspect of Mycologyremainsunder-explored in Côte d'Ivoire and more specifically in Africa[11]. Moreover, the genus*Pleurotus*is an ediblemushroomwith high nutritional value, easygrowth on substrate and good development in rustic conditions[12]. It iseasilygrown on a widevariety of agricultural residues, such as straw, grass, sawdust, coconuthusk, maizeseed, sugarcane bagasse and others of an organic nature. This excellent developmentis due to the production of certain lignocellulosic enzymes thatalloweasydegradation of lignin and cellulose fromwood, as well as other plant substratesused for thisparticularcrop [12]. The aim of thisworkis to improve the productivity of the fungi *P. eous* and *P. ostreatus*, throughdifferent formulations of ricestraw.

2. MATERIALS AND METHODS

2.1 Study sites

The department of Daloa lies between latitude 6°53'58'' North and longitude 6°26'32'' West. The departmentcovers an area of 15,205 km² and has an estimated population of 705.378. The site islocated at the Jean Lorougnon Guédé University and issubject to the sameclimaticcharacteristics as the study area. The Universityislocated to the north-east of the town of Daloa. It lies between latitude north (6°54') and longitude west (6°26'), covering an area of around 415 hectares. It isinfluenced by a humid tropical climate, withrainfallrangingfrom 1,200 to 1,600 millimetres per year[13]. Temperatures range from 25°C to 28°C, with an average of 26.62 ± 1.02°C. Relative humidity varies from 73 to 84%, with an average of 79.83 ± 4.12%[14](Figure 1).

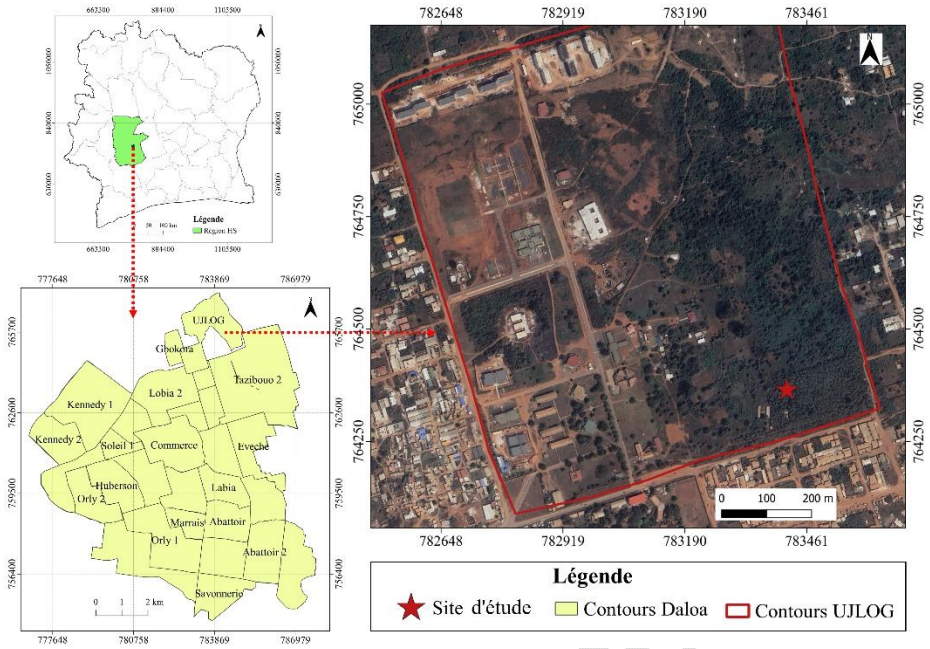


Fig. 1. Map of the study site [14]

2.2 Materials

2.2.1 Biologicalmaterials

Rice straw, rice bran and sawdust (organic plant matter) wereused as substrates for fruiting carpophores. The spawns of *P. ostreatus* and *P. eous*weresupplied by the Jean Lorougnon Guédé University in Daloa.

2.3 Methods

2.3.1Preparation of the ricestrawsubstrate

The stems and leaves of Orizaspwerecollectedfrom a ricefield on the study site after the harvestperiod, dried in the sun for a fortnight and cutinto 2-3 cm pieces. Agricultural lime and rice bran wereadded in varying proportions (1% agricultural lime; 0-15% rice bran) to obtainseveral formulations of culture medium for the differentmushrooms. The substrateswereмoistened, immersed in a barrel and boiled for 1h 30min. The

substratesweredrainedusing a metal drainer for 6 hours and packed in heat-resistantbags (30 cm x 17 cm) at a rate of one kilogram of substrate per bag. The moisture content and pH of the substrateweredeterminedusing the THREE-WAY METER.

Comment [M8]: Boiled at what temperature ?

2.3.2 Preparation of the sawdustsubstrate

In our trials, the sawdustsubstrateis the reference or control substrate (F0). The sawdustwascollectedfrom a local sawmill. It is the main substrateused by all oystermushroomproducers in Côte d'Ivoire. It isused in the following proportions (97% sawdust, 1% agricultural lime and 2% rice bran). The mixture ismoistened to a level of 85-90%, placed in a pile and coveredwith black plastic. Everythreedays, using a shovel, the mixture isturned over to speed up the decomposition process and ensurethat the substrateiscompletelycooled. The moisture content and pH of the substrateweredetermined at the end of the composting process. The substratewaspacked in heat-resistantbags at a rate of one kilogram per bag (30 cm x 17 cm) using a digital scale (ScoutTMpro; model: ScoutTM prospu602) and thensterilised in a steam barrel for 2? hours. Aftercooling the sachets for 24 hours, theyweretransferred to a room for inoculation.

Comment [M9]: Was it sterilised two times ? before and after packaging, please be detailed.

Table 1. Composition of fruitingsubstrates

	Formulations				
Compositions	F0	F1	F2	F3	F4
Sawdust	97%	%	0%	0%	0%
Rice straw	0%	99%	94%	89%	84%
Rice bran	2%	0%	5%	10%	15%
Agricultural lime	1%	1%	1%	1%	1%
Moisture content	50 % 60%	50 % 60%	50% 60%	50 % 60 %	50% 60%
pH	7-8	7-8	7-8	7-8	7-8

2.3.4. Inoculation of the varioussubstrates

Inoculation of the substratesconsisted of sprinklingtwotablespoons of spawn of P. eous and P. ostreatus onto the substrates. The bagswerethensealedwith a ring of PVC tubing and coveredwith plastic film, thenheld in place with a plastic strap.

2.3.5 Incubation

Incubation is the stage duringwhich the myceliuminvades the substrates. This stage takes place in a dark room. The bags are placedvertically on shelvesdesigned for thispurpose. During the colonisation process, a number of parameterswereмeasured and othersestimated, including:

- Colonisation height :

The colonisation heightis the distance covered by the mycelium front on the substrate.

This heightwasmeasuredusing a graduatedrulerfrom the point of inoculation to the front of the mycelium. This value wasused to determine the colonisation rate of the mycelium on the substrates. The followingformulaewereused to calculatetheseparameters.

- Mycelium invasion time or incubation time

This measurementisdeterminedafter the mycelium has colonised the entire bag,

- The colonisation rate

The colonisation rate (CT) wasdetermined by the following formula

$$TC=d\times100/LS$$

TC = colonisation rate, d = colonisation height and LS = bag length

2.3.6Fructification

Once the substrateshad been fullycolonised, theyweretransferred to the fruiting room. In this room, the bagswereplacedhorizontally on top of eachother on shelves and openedwith a knife. The room waswateredtwice or three times a day to increase the relative humidity and encourage the appearance of primordia. A number of fruitingparameterswereмeasured, including :

- Cap diameter

The diameters of the caps of the *Pleurotusoeus* and *Pleurotusostreatus*mushrooms in the different formulations weremeasuredusing a graduatedruler.

- Biologicalefficiency (%)

Biologicalefficiency, alsoknown as yield, wascalculated by multiplying by 100 the ratio of the freshweight of the carpophore or total harvest to the dry weight of the substrate.

Biological efficiency (%)= (fresh weight of the carpophores /dry weight of substrate) * 100

- Survival rate of primordia (TSP)

The primordia and mature carpophores werecounted and the survival rate of the primordia wasassessedusing the following formula:

TSP (%) = (number of mature mushrooms / number of primordia)*100

2.3.7Data processing

Curves and histogramswereplottedusing Excel. R software version 4.3.2 (2021-11-01) wasused to perform the two-factor ANOVA test at the 5% threshold.

3. RESULTS AND DISCUSSION

3 .1RESULTS

3.1.1Assessment of the growthheight of *P. ostreatus* and *P. eous*

3.1.2Growthheight of *P. ostreatus* on ricestrawsubstrate

Mycelialgrowth of *P. ostreatus*occurred in severalways. On culture media F1, F2 and F4, exponentialgrowthwasobservedfrom the beginning to the end of incubation. However, therewas a variation in the date of appearance of the colonisation height. On substrate F2, itwasobserved on day 9. On the other hand, itappearedearlier on the F1 substrate (the height of colonisation wasobservedjustafter the 3rd day of incubation). On the other hand, the mycelium front appearedlate on culture medium F4 (after the 21st day of incubation). In addition, an exponentialgrowth phase followed by a stable growth phase wasobserved on substrate F3. The exponentialgrowth phase (between the 6th and 36th) is longer than the stable growth phase (between the 39th and 51st). All these colonisation heights are smallerthanthoseobtained on the F0 substrate (sawdust, F0= 21 Cm) (Figure 2a).

3.1.3Growthheight of *P. eous* on ricestrawsubstrate

On culture media F1, F2, F3 and F4, the mycelium fronts of P. eousevolved in the sameway. An exponentialgrowth of the myceliumhad been observedduring incubation. For all thesesubstrates, the height of colonisation appearedfrom the thirdday of incubation. However, on culture medium F4, mycelialgrowthoccurred in two phases. These phases are the exponentialgrowth phase and the stable growth phase. The exponentialgrowth phase occursbetweenday 3 and day 30 of incubation. Finally, the stable growth phase beginsafter the 30th day and ends on the 52nd day. Furthermore, the height of colonisation obtained by growing*P. eous* .on an F0 substrate (sawdust) was the greatest (h= 19 Cm)(Figure 2b).

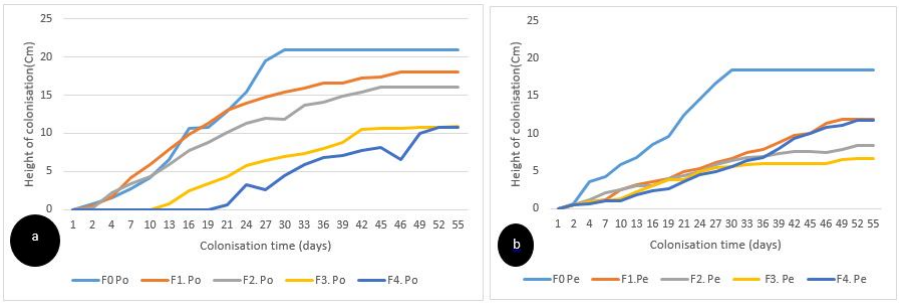


Fig. 2. Colonisation heights of *P. ostreatus* (a) and *P. eous* (b) on differentstraw formulations

(F1= 99% ricestraw + 1% agricultural lime + 0% rice bran, F2 = 94% ricestraw + 1% agricultural lime + 5% rice bran, F3= 89% ricestraw + 1% agricultural lime + 10% rice bran and F4= 84% ricestraw + 1% agricultural lime + 15% rice bran).

3.1.4Rate of colonisation

The rate of colonisation varies according to the substrate and the species of fungus. The highest colonisation rates are obtained by *P. ostreatus*. These rates varyfrom 50 to 100%. On the other hand, the lowest colonisation rates wereobservedwith the species*P. eous*. These colonisation rates for *P. eous*rangedfrom 90% to 30%. Generallyspeaking, for thesetwospecies of fungus, the colonisation rate drops when the quantity of rice bran isincreased. Thus, addingrice bran in increasing doses to a ricestrawsubstratereduces the colonisation rate of *P. ostreatus* and *P. eous*. But 5% rice bran is the dose needed to increase the rate of colonisation of *P. eous* on the ricestrawsubstrate. Beyond thisquantity, the addition of rice bran reduces the colonisation rate of *P. eous*. However, rice bran is not recommendedwhengrowing*P. ostreatus* on a strawsubstrate (Figure 4). *P. ostreatus*colonises the sawdustsubstratebetterthan*P. eous*. The best colonisation rates in thisstudywereobtainedwhengrowing*P. ostreatus* and *P. eous* on sawdustsubstrate. Figures 3 and 4 illustratethis information.

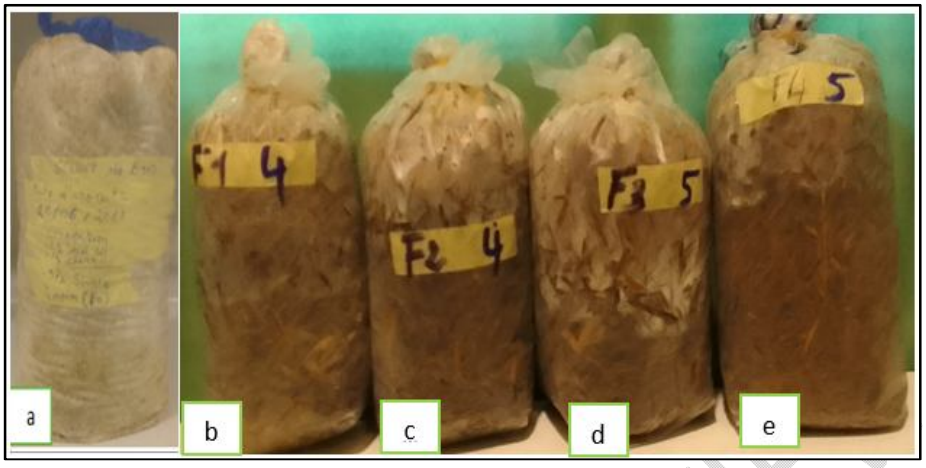
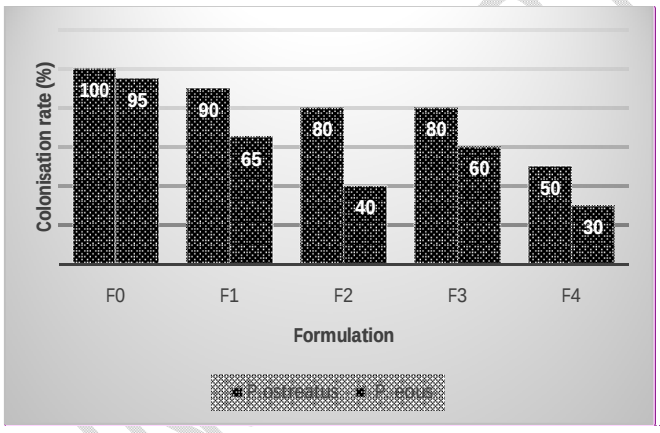


Fig.3.Colonisationof differentsubstrates

(a :F0= 99% Sawdust+1% Agricultural Lime+ 2% Rice Bran ; b : F1= 99% Rice Straw +1% Agricultural Lime+ 0% Rice Bran ; c : F2 = 94% Rice Straw + 1% Agricultural Lime + 5% Rice Bran ; d : F3= 89% Rice Straw + 1% Agricultural Lime + 10% Rice Bran and e : F4= 84% Rice Straw + 1% Agricultural Lime + 15% Rice Bran).



Comment [M10]: This is a scientific study, the histogram should have error bars.

Fig. 4. Colonisation rates of *P. eous* and *P. ostreatus* onricestraw formulations

(Tc : Colonisation rate of *P.ostreatus*, Tc : *P.eous* colonisation rate,¨ F0= 99% Sawdust+1% Agricultural Lime+ 2% Rice Bran F1= 99% Rice Straw +1% Agricultural Lime+ 0% Rice Bran, F2 = 94% Rice Straw + 1% Agricultural Lime + 5% Rice Bran F3= 89% Rice Straw + 1% Agricultural Lime + 10% Rice Bran and F4= 84% Rice Straw + 1% Agricultural Lime+ 15% Rice Bran).

3.1.5Combinedeffect of formulation and mushroomvariety on fruitingparameters

The two-factor ANOVA test performed at the 5% thresholdgives the following information:

Apart from the number of carpophore harvested (Ncr), substrate formulation and mushroomvariety have a significanteffect on all otherfruitingparameters. However, the combination of thesetwofactors (Formulation Vs Variety) had no significanteffect on the number of primordia (Pri) and runts (Avo). On the other hand, this combination does have a significant influence on the otherfruitingparameters (number of carpophore harvested, stipe length, carpophore diameter, follow-up rate of.

Table 2. Combinedeffect of formulation and mushroomvariety on fruitingparameters

	Fruiting parameters							
	pri	avo	Ncr	ls	dm	TVS	pf	
formulation	0,001 ***	0,001***	0,177	0,001 ***	0,001***	0,007 **	0,001***	Pr
variety	0,023 *	0,014 *	0,293	0,001 ***	0,001 ***	0,516	0,001***	
Formulation Vs variety	0,463	0,755	0,003 **	0,001**	0,001 ***	0,001 ***	0,7407	
residual	82092,26	46891,26	14871,72	1138,82	1152,14	184829, 26	167245,26	

Meaning codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

avo: runt, Ncr: number of carpophore harvested, Pf: freshweight, dm: averagediameter, ls: stipe length, TVS: primordial follow-up rate and Pr: probability of occurrence.

Comment [M11]: This is not detailed, is there significance difference between the parameters ?

3.1.6Biologicalefficiency

The twomushroomspecies (*P. ostreatus*and*P. eous*) werefruiting on the differentsubstrates (Figure 6). Biologicalefficiency (BE) varies according to the mushroomspecies and the fruitingsubstrates. *P. eous*produced more carpophores than*P. ostreatus* on the F0 substrate. The lowestbiologicalefficiency values wereobtained by growing*P. eous* on the differentsubstratescontainingricestraw. Theserangedfrom 0% substrate(F4) to 5% substrate (F3). For thismushroom, the addition of rice bran increasesbiologicalefficiency. But above 10% of rice bran, biologicalefficiencywaszero.In the absence of rice bran in the ricestrawsubstrate, EB reaches a maximum value of 30%. The addition of rice bran in

increasing doses significantlyreduces EB, down to a value of 4% for an addition of 15% rice bran (Figure 7).

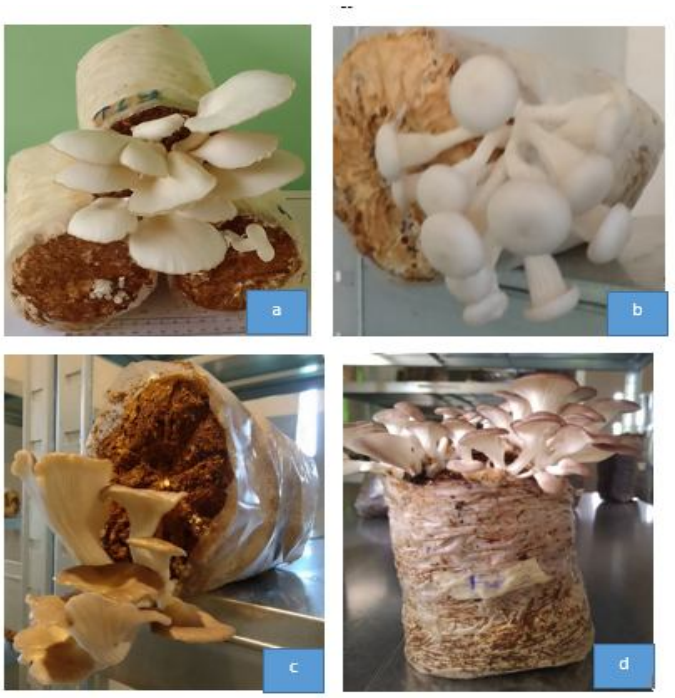


Fig. 5. Fructification of *P. eous* and *P. ostreatus* on differentssubstrates

(a= photo of *P. ostreatus* on sawdust b= photo of *P. ostreatus* on ricestraw C= photo of *P. eous* on sawdust d= photo of *P. eous* on ricestraw)

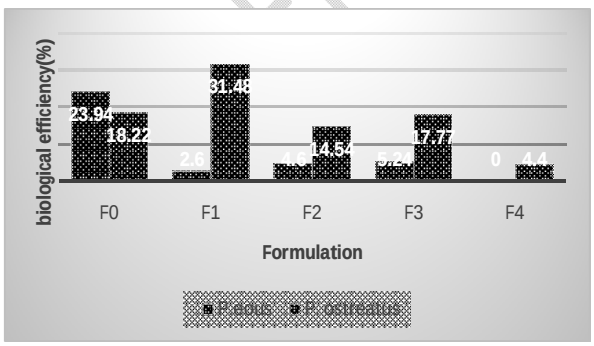


Fig. 6. Biologicalefficiency values for *P. eous* and *P. ostreatus*grown on differentsubstrates

(F0= 99% sawdust + 1% agricultural lime + 2% rice bran, F1= 99% ricestraw + 1% agricultural lime + 0% rice bran, F2 = 94% ricestraw + 1% agricultural lime + 5% rice bran, F3= 89% ricestraw + 1% agricultural lime + 10% rice bran and F4= 84% ricestraw + 1% agricultural lime + 15% rice bran).

3.1.7Correlationbetweendifferent fructification parameters of *P. ostreatus*

Pearson'scorrelation coefficient r wasused to assess the degree of association between the different variables studied. Somestrongcorrelationswereobservedbetween the variables measured. It wasnotedthatmost of the correlation coefficients werelow. Only the pairs pri-avo (0.80), ls-dm(0.96), pf-dm (0.80), TVS-dm(0.78), pf-ls(85) and TVS-ls(82) showed a strong positive value. This meansthatthereis a correlationbetweenthese variables. The strongestcorrelationwasobtained by the ls-dm pair (0.96) (Table III). Thus, the higher the number of primordia, the higher the number of runts. Also, the longer the stipes of the carpophores, the widertheir caps and the larger the masses of the carpophores. Finally, the longer the stipes of the carpophores, the higher the follow-up rate of the primordia.

Table 3. Matrix of correlationsbetween the eight variables measured in *P. ostreatus*

	avo	dm	EB	ls	Ncr	pf	pri	TVS
avo	1							
dm	-0.19	1						
EB	0.10	0.17	1					
ls	-0.13	**0.96**	0.16	1				
Ncr	0.35	0.45	0.34	0.56	1			
pf	-0.14	**0.80**	0.13	**0.85**	0.59	1		
pri	**0.80**	0.12	0.25	0.21	**0.76**	0.20	1	
TVS	-0.30	**0.78**	0.08	**0.82**	0.49	**0.72**	0.03	1

avo: runt, Ncr: number of carpophore harvested, Pf: freshweight, dm: averagediameter, ls: stipe length, TVS: primordial follow-up rate and EB: biologicalefficiency.

3.1.8Correlationbetweendifferent fructification parameters of*P. eous*

The degree of association between the different variables studiedwasestimatedusingPearson's r correlation coefficient. Strong correlationswereobservedbetween the variables measured. The pairs ls-dm(0.96), pf-dm(0.80), pf-ls(0.85), pri-avo(0.85), pri-Ncr (0.76), TVS-dm(0.78), TVS-ls(0.72) and TVS-pf (0.78) have strong positive r values. There is a correlationbetweenthese variables. This meansthat the higher the number of primordia, the

higher the number of runts and the number of carpophores harvested. Also, when the mushroom has a long stipe, the diameter of its cap is long and the mushroomwill have a large mass. In addition, when the survival rate of the primordia increases, the mushroom has a long stipe. Finally, when the survival rate is high, the mushroom has a broad cap. Table IV provides more details.

In summary, the pairs ls-dm, pf-ls, pri-avo, TVS-dm, TVS-ls, TVS-pf showed a strongcorrelation for both*P. eous* and *P. ostreatus*. But in *P. ostreatus* the r coefficient shows that the greater the number of primordia, the greater the freshweight of the carpophore. In *P. eous*, on the other hand, when the number of primordia is high, the number of carpophore is high. There istherefore a diversity of correlationsbetweenthesetwospecies of fungi.

Table 4. Matrix of correlationsbetween the eight variables measured in *P. eous*

	avo	dm	EB	ls	Ncr	pf	pri	TVS
avo	1							
dm	-0.19	1						
EB	0.10	0.17	1					
ls	-0.13	**0.96**	0.16	1				
Ncr	0.35	0.45	0.34	0.56	1			
pf	-0.14	**0.80**	0.13	**0.85**	0.59	1		
pri	**0.80**	0.12	0.25	0.21	**0.76**	0.20	1	
TVS	-0.30	**0.78**	0.08	**0.82**	0.49	**0.72**	0.03	1

(avo: runt, Ncr: number of carpophore harvested, Pf: freshweight, dm: averagediameter, ls: stipe length, TVS: primordial follow-up rate and EB: biologicalefficiency)

3.2Discussion

The colonization and fruiting capacity of two edible mushroom*P. eous* and *P. ostreatus*, were studied on different formulations in comparison with sawdust used as reference substrates in Côte d'Ivoire. Several formulations of rice straw-based substrates were inoculated with the spawn of *P. eous* and *P. ostreatus*. A variation in the date of appearance of the mycelium front on the different substrates was observed. The mycelial filament of *P. eous* was observed on all substrates three (3)

days after inoculation. On the other hand, there were three dates (3rd, 9th and 21st day) of appearance of the mycelial front in *P. ostreatus*. Thus, colonization of rice straw substrates depended on the species of mushroom and the substrate. Indeed, this diversity could be explained by enzyme production during the incubation phase. This assertion is corroborated by[15]who argue that, in some cases, high levels of additives are toxic to mycelialgrowth. In addition to the toxicity of the nutrientsupplied, thereisalsonutrientcompetition. Contrary to theseauthors, [16] and [17]assertthat the more nutrients are added to a substrate, the greateritssusceptibility to infection, and the greater the competitionbetweenoystermushrooms and contaminants; thiscompetitionthenreduces the colonization speed of the fungus, hence the delayobserved. Incubation times for *P. ostreatus* range from 51 to 57 days, and for *P. eous*from 52 days on all culture substrates. Thesemycelial invasion times differfromthoseobtained by [18]. Theseauthors state that invasion times varybetween 15-30 days. This differencecouldbeexplained by the choice of species and substrates. For theseauthorshadgrownLentinussajor-caju and *Pleurotusflorida* on substratesbased on Acacia pods, *Terminaliasuperba*sawdust, and sugarcane bagasse (*Saccharumofficinarum*). The addition of rice bran in increasing doses to the ricestrawsubstratereduced the colonization rate of *P. ostreatus* and *P. eous*. This finding shows that the addition of rice bran was not at all favorable to mycelialgrowth. This point of viewisalsoconfirmed by[19]. Biologicalefficiency (BE) varies according to fungus species and growing medium. The lowest values of biologicalefficiencywereobtainedwhengrowing*P. eous* on differentsubstratescontainingricestraw. These values rangedfrom 0% (F4) to 6% (F3). These values, of biologicalefficiency are differentfromthoseobtained by [18]. According to them, the yieldisbetween 10 % and 12%. In fact, theseauthorshadgrown*Lentinuscladopus* on substratesbased on sugarcane bagasse (*Saccharumofficinarum*). Thesedifferences are simply a consequence of the choice of mushroomsspecies and growing media.

4. Conclusion

The aim of thisstudywas to demonstrate the use of ricestraw for the cultivation of ediblemashroom. The mycelial filament of *P. eous*wasobserved on all substratesthree (3) daysafter inoculation. In contrast, therewerethree dates (3rd, 9th and 21st day) for the appearance of the mycelial front in *P. ostreatus*. The lowestyieldswereobtained by growing*P. eous*. Whenrice bran content islow, carpophore production in *P. ostreatus*ishigherthan in the control (F0). On the other hand, in the same condition, *P. eous* carpophore production isverylowcomparedwith the control. The correlation coefficient r shows that the greater the number of primordia, the greater the freshweight of the carpophore. In *P. eous*, on the other hand, a high number of primordia results in a high number of carpophore. There istherefore a diversity of correlationsbetweenthesetwospecies of fungi. In the context of thisresearch, itisquitesatisfactory to produceedible carpophores of *P. ostreatus*and *Pleurotuseous*fromricestraw, thusadding value to yields. For thisstudy, only*Pleurotuseous* and *P. ostreatus*wereseeded on thesedifferentsubstrates. It wouldbewise toextend the study to othermushroomspecies. It wouldbewise to carry out biochemical analyses to determine the intrinsicquality of carpophores produced on ricestrawsubstrates.

Comment [M12]: Rephrase. Eg Therefore, further research.....

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) herebydeclarethat NO generative AI technologies such as Large LanguageModels(ChatGPT, COPILOT, etc) and text-to-image generators have been usedduringwriting or editing of thismanuscript.

References

[1].FAO (Food and Agriculture Organization). (2015). The State of Food and Agriculture Social Protection and Agriculture: Breaking the Vicious Cycle of Rural Poverty. ISBN 978-92-5-108861-5.

[2]. FAO (Food and Agriculture Organization). (2017). The State of Food and Agriculture 2017.

[3]. Amani G., Cubaka A., Baguma G., Irenge E., Casinga C., and Cirimwami L. (2019). Effect of agricultural waste on the phenology and yield of two strains of Pleurotus ostreatus (Jacq,Fr,) Kummer (Fungi, Basidiomycotina).

[4]. FIRCA (Interprofessional Fund for Agricultural Research and Consulting) (2011). « the rice sector. FIRCA, 40. Accessed August 31, 2019. https://firca.ci.

[5]. Pérez J., Munoz-Dorado J., Rubia T. & Martinez J., (2002) Biodegradation & biological treatments of cellulose, hemicellulose & lignin: an overview, International Microbiology, 5, 53-63.

[6]. Wathumbe P.A. & Mada B. B. (2020), Production of edible carpophores of Pleurotus sajor-caju (Fr,) Singer based on rice husks, African Journal of Environment and Agriculture, 3(1). 16-22.

[7]. Gévry M-F., Simard D., Roy G. (2009). Edible mushrooms of Lac-Saint-Jean.

[8]. (Urben, 2004) Urben A.F. (2004). Produção de cogumelospormeio de tecnologiachinesamodificada, EmbrapaRecursosGeneticoseBiotecnologia, Brasília (in Portuguese).

[9]. Ngezimana W., Mtaita A.T., Shoko M., Tagwira M. (2008). Improving biological efficiency of Oyster mushroom, Pleurotus ostreatus Fr, (Polyporaceae), through composting and use of organic supplements, Int, J, Biol, Chem, Sci., 2(1): 72-80.

[10]. Zied C. D., Sanchez E. J., Noble R. and Pardo-Giménez, (2020), Use of Spent Mushroom Substrate in New Mushroom Crops to Promote the Transition towards A Circular Economy, https://doi,org/10,3390/agronomy10091239.

[11]. Soko D. F., Dally T., Kotchi V., N'guessan F. F., Boye M. A.D, Ayolie K., Aké S. (2018) Influence of spwan age (seed) on the carpophores production and nutritional quality of the edible mushroom Pleurotusotreatus in Allokoua (Côte d'Ivoire), Asian Journal of Science, 59 p.

[12]. Boulmerka A. &Laoufi O. (2017). Test of multiplication and cultivation of oyster mushrooms on a laboratory scale. Thesis presented for the award of the Master's Degree Field: Natural and Life Sciences Sector: Biological Sciences Specialty: Microbiology, Option: Biotechnology of Fungi:

Fermentation and production of fungal substances. University of the Mentouri Brothers Constantine. Faculty of Natural and Life Sciences. Algeria. 42 p.

[13]. Coulibaly S, Kouame D, Dro B, Yeboua BAA, Salla M. 2021. Potential honey flora of the Jean Lorougnon Guede University site (Daloa, Central West Ivory Coast): What is the beekeeping interest? International Journal of Innovation and Scientific Research 58(1), 26-38 P.

[14]. N'Guessan A.P., Tano D.K. C., Yao N., Tah G, Tatiana T. and Dao H. (2024). Effects of the entomopathogenic fungi Metarhizium anisopliae and Beauveria bassiana on adults of Coelaenomenoderalameensis Berti and Mariau, 1999 (Coleoptera: Chrysomelidae) pest of oil palm (Daloa, Côte d'Ivoire). International Journal of Biosciences. ISSN: 2220-6655 (Print), 2222-5234 (Online) Vol. 24, No. 4, p. 71-82.

[15]. Dibaluka, M.S. (2012). Study of macromycetes in the city of Kimvula and its surroundings (Bas-Congo/DR Congo): Diversity and productivity in open forest, ethnomycology and cultivation of edible saprotrophic species, Doctoral thesis, University of Kinshasa.15-60.

[16]. Oei, P. (1993), Mushroom cultivation, Collection « Le point sur » Technical guide, CTA, TOOL, GRET, Amsterdam, Netherlands, 318 P.

[17]. Curvetto, N.R., D. Figlas, R.J. Devalis, and S.E. Delmastro. 2002a. Growth and productivity of different Pleurotus ostreatus strains on sunflower seed hulls substrate supplemented with N-NH4+ and/or Mn(II). Bioresource Technology 84(2):171-176

[18]. Makanua D. I., Mpulusu D. S., Kasali L. J. and Degreef J. (2015). Culture of three species of edible lignicolous mushrooms from the Kinshasa region (DR Congo) on various composted lignocellulosic substrates, Africa Science 11(3): 241-261.

[19]. Kiyuku et al. (2020). Kiyuku P., Dibaluk S. and Degreef J. (2020). Growing mushrooms in the African Great Lakes region. A guide for extension workers and smallholder farmers in rural areas. DOI (Digital object identifier): 10.5281/zenodo.3941509. ISBN (International Standard Book Number).