Pesticidecontaminationofurbanlettuce(*Lactucasativa*L.)inYamoussoukro(Côte d'Ivoire).

Abstract

Context: Lettuceisoneofthemostpopularleafyvegetablesin Côted'Ivoire.Oftenproduced inurbanagricultureunderuncontrolledconditions,lettuceis saidtocontainpesticideresidues thatareincreasinglyusedinagriculture.Theaimofthisstudywastoassessthepesticidecontent ofurban-grownlettuceconsumedbythepopulationof Yamoussoukro thepoliticalcapital of Côted'Ivoire.

Methods: Acharacterizationoflettuceproductioninurbanagriculturewascarriedoutthrough asurveyof117urbanproducers. Fifteen(15)lettuces sampleswerecollectedfromthree emblematicsiteslocatedintheheartofthecity. ThesesampleswereanalyzedusinganHPLC chain(Waters alliance)toidentifyandmeasurethepesticidecontentoflettuceproducedand consumedinYamoussoukro.A chemicalriskassessmentforpesticideswascarriedoutusing the*CodexAlimentarius*method.

Results: Thestudyrevealedthatnationals(Ivorians)dominatelettuceproductioninthecityof Yamoussoukrowitharateof58.97%.Thisactivityisdominatedbymenwitharateof55.56%. Variouspesticideresiduesgroupedintonine(9)familiesweredetectedinlettuces,someatvery alarminglevels. AccordingtoWHO,FAOandEuropeanCommunitystandards,33%ofthe sampleswereunacceptable,andthereforeunfitforhumanconsumption.Theassessmentof the healthrisklinkedto consumptiondueto thepresenceofParathioninlettucewouldbe28%for chronicintoxicationand2%foracuteintoxication.The riskofchronicintoxicationby Dimethoate would be47%,and ofacute intoxication 1%.ForbothChlorpyriphos and Spirodiclofen,the risksofchronicpoisoningofpopulationsare real,butthepopulations exposedwouldbelow.

Conclusion: Urban-grownlettucefrom Yamoussoukro,thepoliticalcapitalofCôted'Ivoire, oftencontainspesticideresiduesinexcessofrequiredstandards. Thislettuce representsa dangerandexposes consumerpopulations tohealthrisks.These very important results must be taken into consideration by politicians.

Keywords:*Lactucasativa*, pesticideresidues,riskassessment,Yamoussoukro

1. INTRODUCTION

Urbanpopulationgrowthinthemajorcitiesofsub-Saharan Africaisincreasingtheneedfor foodcrops,especiallymarketgardenproduce.In the many shallows and other drainage areas left vacant in cities, varieties of fresh fruit and vegetables are grown and ready for consumption. Yamoussoukro, the political capital of Côte d'Ivoire, is no exception to the rule, as the many lakes surrounding the city make it an ideal location for market gardening.(**Tano*etal.*, 2011**;**Kpan*etal.*,2019**). Marketgardeningisthereforeanincome-generatingactivityfor urbanproducers.Itisalsoasourceofempowermentandimprovedlivingconditionsformarket gardeners**(Kouakou,2019;AGRA,2021)**. Fruits andvegetablesfromthis agricultureareactivelyinvolvedintheurbanhumandietduetotheiraccessibilityandbeneficial healtheffects**(Yao*etal.*,2016;Dakuyo*etal.*,2020).**Theseincludelettuce,oneofthemost popularleafyvegetables (**Kouassi*etal.*,2024**).

However, urbanproductionoflettuce,likethatofothervegetables,facesenormousdifficulties. Thesedifficultiesarelinkedtocultivationpractices, soilinfertility,theuseofpesticidesandthe poorqualityofthe waterused.Indeed,withthe implementationofthis emergencyagriculture oftenrequiresheavyuseofpesticidestocombatpests. Pesticideuseisincreasedparticularlyin lettuceproduction, whichremainsacrophighlysusceptibletopests**(Tano*etal.*, 2011;Soro*et al.*,2018)**.Pesticidesarechemicalorbiologicalagentscapableofdestroying pestsor controllingtheirgrowth andreproduction. Theysignificantly reducecrop lossesandincrease cropyields**(Son,2018;Orou*et al.*,2024).** Apart fromtheirbeneficialeffects,pesticidescan haveharmfulforhumansand increaseenvironment pollution **(Saliou*etal.*,2013; Ekra*etal.*,2023)**. Indeed,poorphytosanitarypractices,intensivepesticideuseand bioaccumulation phenomena cancauserespiratory problems,cancer,headaches, skinand mucous membraneirritationandevendeath**(Kpan*etal.*,2019;Mambe-Ani*etal.*,2019)**. Despitealertsand incidencestudiesofphytosanitarypracticesinurban marketgardening,the levelofpesticidecontaminationinlettuceproducedbyurbanfarmersislessstudied.Itisinthis contextthatthisstudywascarriedoutin Yamoussoukro,acitywithahighlevelofurban agriculturalproduction. Theaimofthestudywasthereforetoassessthelevelofpesticide contaminationoflettuceproducedandconsumedin Yamoussoukro.Specifically,theaimwas toidentifypesticide residuesinlettuce,determinelevelsandassess thehealthriskassociated withconsumptionofthis leafyvegetable.

2. MATERIALSANDMETHODS

2.1. Studyarea

The study area was the city of Yamoussoukro, in central Côte d'Ivoire. The low-lying areas near the Basilica known as Petit Bouaké, behind the Presidency and behind the CIE were chosen as study sites. These sites are located right in the city center.

2.2. Lettuce productiondatacollection

Inordertocarryoutsurveysatfarmerlevel,questionnairesweredrawnup. Theseusedto gather information on urbanlettuce in Yamoussoukro. Thelettucecharacterization and productionsurveywasdividedintotwomainparts.The firstpartprovidedinformationonthe profileofproducers(gender,age,nationality,levelof education)andthesecondpartconcerned thecharacteristicsofurbanproduction(sourceofirrigationwater,typeof fertilizeranduseof pesticides). Inall, onehundredand seventeen(117)lettucefarmersweresurveyed.Thepeople surveyedwereofboth sexes,fromalllevels ofeducationandallsocialstrata.

2.3. Sampling

ThreesitesinthecenterofYamoussoukrowere selected.Oneachsite,threedifferentbeds formedastudyblock.Atcropmaturity, threelettuceplants (onesample)weighing500gwere harvestedandpackedinastomacherbag.Thesebagswerecarefullylabelledwithanindividual identificationnumber. Theywerethentransportedincoolerscontainingcoldaccumulatorsto thelaboratoryfortoxicologicalanalysis. Atotalof15lettucesamples(5perstudysite)were collected.

2.4. Pesticideanalysis techniques

Pesticide residue analysis was performed using the method described by **Yao *et al.* (2016)**.

2.4.1. Extractionand separation

Toextractpesticideresiduesfromlettuce,50goflettuceshredwastaken,then50mlofdouble-distilledwaterand100mlofacetonewereadded.Thismixturewashomogenizedfor3minutes usinganUltraTuraxblender. The resultinghomogenatewasfilteredthroughWhatmanpaper containingglasswoolandanhydroussodiumsulfate. Toseparatetheaqueousphasefromthe organicphase,20gNaClwasaddedtothefiltrate,andthemixtureshakenvigorously. After shaking, themixturewaslefttostandforafewminutesinaseparatingfunnel.Thesupernatant wascollectedanditsvolumereducedto10mlusinganevaporator(BUCHI).Aglasscolumn containing20gofactivatedfluorisil(ACROS)wasconditionedwith5mlacetone.The10ml extractwas passedthroughthecolumn,1to2drops persecond. The filtratewas collectedina round-bottomedflaskandshakenforaboutaminute,thenlefttostandfor10to15minutes.A 5mlaliquotofthefiltratewasevaporatedtodrynessat40°C. Afterevaporation,theround-bottomedflaskwaslefttocoolforoneminute.Pesticideswererecoveredwith5mlhexaneand transferredtovials forquantificationof activeingredientresidues.

2.4.2. Determinationofpesticideresidues

For Pesticides detection,anHPLCchain(Watersalliance)equippedwithaSIL-20A sampler,LC-20ATpump,TRAYtank,DGU-20A5degasser,CTO-20A ovenandSPD-20A UV/VISdetector was used.DataacquisitionwasperformedonacomputerrunningLCsolutionsoftware. Themobilephaseconsistedofwater(10%-30%)andHipersolvgradeacetonitrile(70%-90%).Elutionwascarriedoutinisocraticmode.ThestationaryphaseconsistedofaShimpack VPODSreversed-phasecolumn(250L x4.6).Wavelengthsrangedfrom210nmto271nm, whileinjectionvolumeswere10µL and20µL.Oventemperaturewassetat40°C.Foreach pesticide,acalibrationwas performedusingthepurestandardoftheknownconcentration. Fromthiscalibration,thepesticidepeakwasidentifiedonthesamplechromatograms.Theareas ofthepeaks (standardsandsamples)wereusedtoquantifythevariousactiveingredients presentinthelettucesamples.Thevarious pesticidelevels werecalculatedusingthefollowing formula:

$$Cp = \frac{Sc \times Ce \times V2 \times Vf \times F}{Se \times Me \times V1}$$

Cp :activeingredientconcentration(mg/kg) ;**Sc :** samplepeakarea ;**Se :** standardpeakarea ; **Ce :**standardconcentration(mg/L); **V1:**volumetobepurified(L) ;**V2 :**volumeafterpurification(L) ;**Vf:**finalvolume(L) ;**Me :**samplemass (kg)and**F :**dilutionfactor.

Thequantitiesofpesticidefoundinlettucesamplesfromthecityof Yamoussoukrowere comparedwiththeMaximumResidueLimits (MRLs)setbytheEuropeanUnion**(EU,2018)** andtheWorldHealthOrganization**(WHO,2019)**.Thiswasusedtodeterminetheacceptability ofthelettucesamples.Pesticidelevelswerealsocomparedwiththe ADIand ARfDofeach chemicalcompoundfortherespectivechronicandacuteriskassessment.

2.4. Dataanalysis

Thevariousdatacollectedareprocessedin**Excel2021**. For pesticidedetermination, datawere processedusing**LCsolution**software.**Past4.17**wasusedtocomparepesticidelevelsbetween sites.**MATLABR2016b**wasused forchemicalrisk assessment. Treatmentresultsare presentedintheformoftables,boxplotsandcurves.These software programs were chosen for their precision in the results and their easier handling.

3. RESULTS

3.1. Profileof urbanlettucegrowers

Theprofileofurbanlettucegrowersissummarized**in** **TableI**below.Lettuceisproducedby bothgendersinthecityofYamoussoukro.Itisdominatedbymen(55.56%),comparedwith 44.44%forwomen.Producersrange inagefrom30to60. Ivoriansaremore interestedinthisactivityin Yamoussoukro,witharateof58.97%.Themajorityoflettuce growerssurveyedinthecityareilliterate,with arateof82.91%.However,therearealso primaryschoolandsecondaryschoolgrowers,withrates of12. and4. respectively.

TableI : Profileofurbanlettuce farmers

		Frequency	Percentage (%)
Age	<30years	19	16,24
	30-60years	86	73,5
	>60	12	10,26
Type	Male	65	55,56
	Female	52	44,44
Nationality	Ivorian	69	58,97
	Burkinabe	36	30,77
	Malian	12	10,26
Studylevel	Illiterate	97	82,91
	Primary	15	12,82
	Secondary	5	4,27

3.2. Inputs usedforlettuce production

ThemaininputsusedinlettuceproductioninYamoussoukro arelistedinTableII.Allfarmerssurveyed(100%)usewaterfromunprotectedwells towatertheirlettuces.Poultrydroppings andchemicalfertilizerswereusedby62.39%ofgrowersin Yamoussoukro.Othergrowers (37.61%)useamixtureofpoultrydung,cowdungandchemicalfertilizertofertilizetheirbeds. Almostallgrowers usepesticides tocontrollettucepestsandiseases.

TableII: Maininputs usedinurbanlettuceproduction

Inputs	Frequencies	Percentages (%)
Waterfromunprotected wells	117	100
Surfacewater	0	0
Poultrydroppings and chemicalfertilizers	73	62,39

Poultrydroppings,cowdung andchemicalfertilizers	44	37,61
Pesticides	117	100

3.3. Pesticideresiduesinlettuce

Toxicologicalanalyses of lettucesamples fromthetown ofYamoussoukrorevealed the presenceoftwelve(12)pesticideresidues.Eachlettucesamplewas contaminatedwithatleast one(1)pesticideresidue. Theseresiduesbelongtothefollowing families**(Table III)**:

Table III : Concentration (mg/kg or ppm) of pesticides residues extracted from Yamoussoukro lettuce

		Yamoussoukro	
		VMax	**CM**
Organophosphates	Parathion	1,31	0,19 ± 0,09
	Chlorpyriphos	1,83	0,47 ± 0,15
	Dimethoate	2,41	0,6 ± 0,18
Pyrethroids	Cypermethrin	2,02	0,39 ± 0,15
	Cyhalothrin	1,64	0,5 ± 0,14
Tetronic Acids	Spirodiclofen	2,71	0,55 ± 0,19
Benzimidazoles / Carbamates	Carbendazim	1,18	0,28 ± 0,1
Organochlorines	Chlorothalonil	1,29	0,31 ± 0,09
Dithiocarbamates	Maneb	1,33	0,12 ± 0,08
Benzamides	Zoxamide	2,58	0,83 ± 0,24
Neonicotinoids	Thiamethoxam	1,03	0,21 ± 0,09
Phenols	Orthophenilphenol	1,04	0,2 ± 0,09

VMax :Maximum Value ; CM : Average Concentration

Statisticalanalysisshowedthattherewasnosignificantdifference(P>0.05) betweensitesin theconcentrations ofParathion,Chlorpyriphos, Dimethoate,Cypermethrin,Cyhalothrin, Spirodiclofen,Carbendazim,Chlorothalonil,Maneb, ThiamethoxamandOrthophenilphenol. Ontheotherhand,asignificantdifference(P <0.05)wasobservedbetweenZoxamidelevels fromone sitetoanother.The highestvalueswere observedinsites2and3 respectively(0.65 mg/kgand1.83mg/kg). The**figures**belowshowtheconcentrationvariabilityofthevarious chemicalelements.

3.3.1. Lettucepesticidecompliancewith standards

Pesticidelevels inlettuce,MaximumResidueLimits (MRLs)andtheirdifferentclasses are summarized**in** **TableIV**.Forsampleswithactiveingredientlevelslessthanorequaltothe MRL,theproductisconsideredacceptable.Ontheotherhand,ifthelevelisstrictlyhigherthan theMRL,theproductissaidtobeunacceptable,andthereforeunfitforconsumption.So samplescontainedlevelswellinexcessoftheMRLslaiddownbytheWHOandtheEuropean Union.Arateof33.33lettucesamples didnotcomplywiththeprescribedstandards,andwere thereforeunacceptableandunfitforconsumption. Theproportionofsamplesconforming to differentstandardswas66.67%.Parathion,aproductrecognizedbythe WHOasextremely dangerousforconsumers,wasfoundinsomesamplesatlevelsexceedingtheMRL.The**figures** belowshowthevariability ofpesticidelevels inlettuceatthevariousstudy sites.

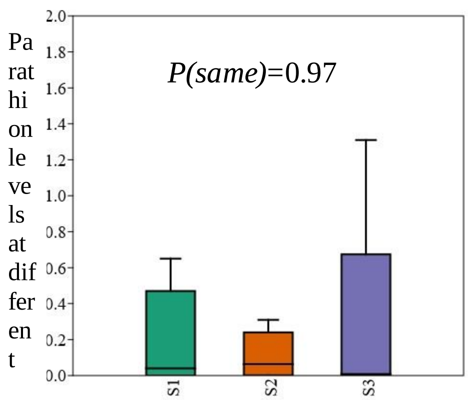

Figure1: Contentvariability inparathionin sites

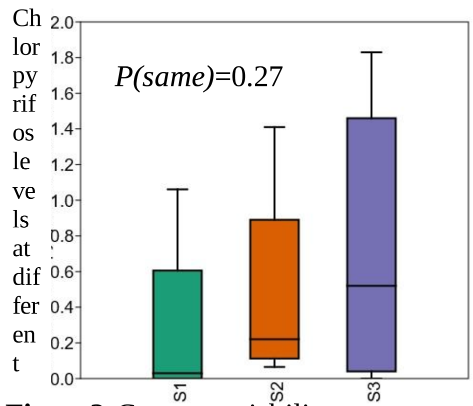

Figure2: Contentvariability inchlorpyrifosatthesites

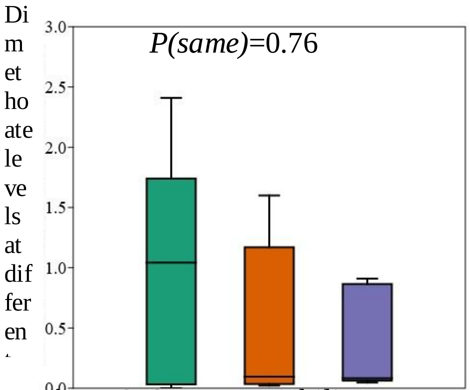

Figure3: Contentvariability indimethoateatthesites

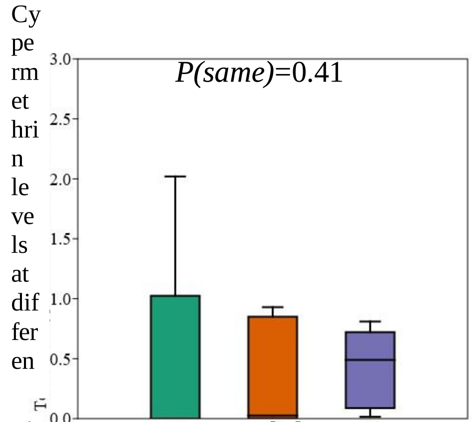

Figure4: Contentvariability incypermethrin atthesites

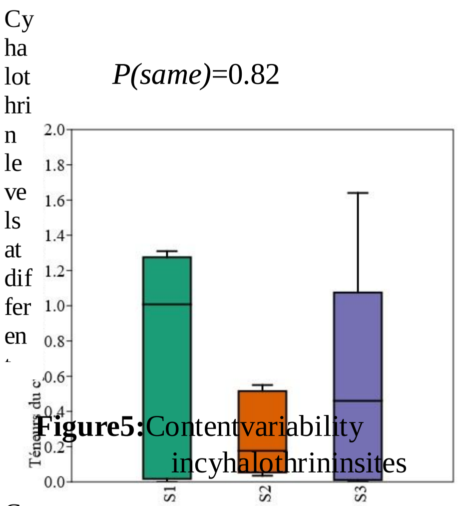

Figure5: Contentvariability incyhalothrininsites

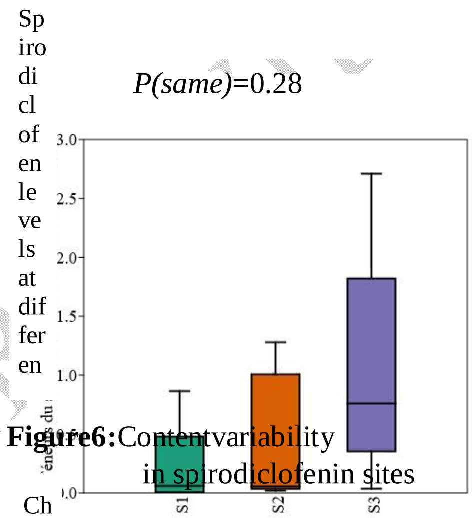

Figure6: Contentvariability in spirodiclofenin sites

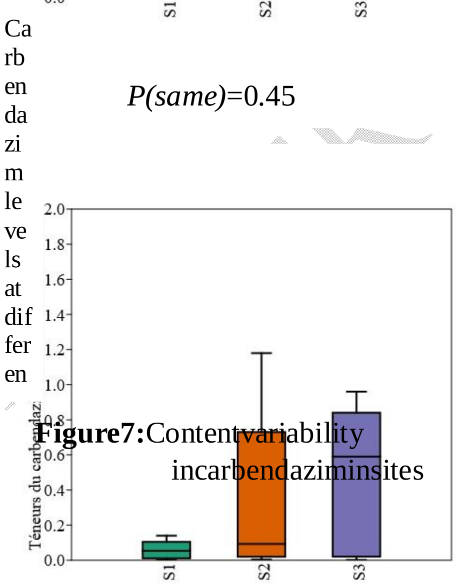

Figure7: Contentvariability incarbendaziminsites

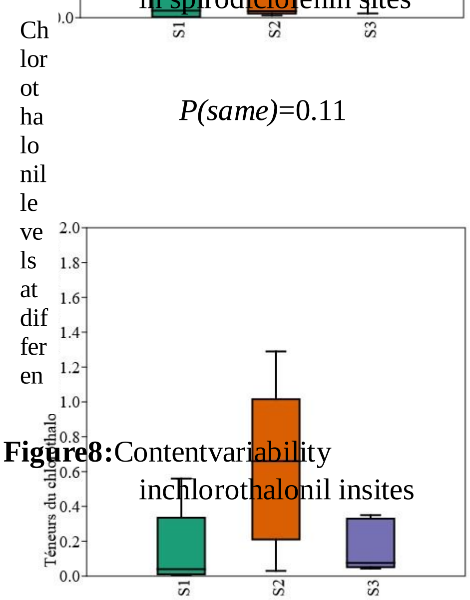

Figure8: Contentvariability inchlorothalonil insites

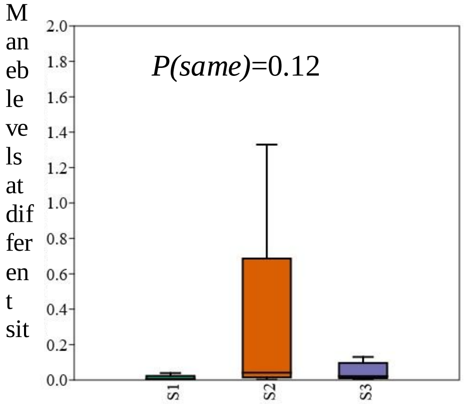

Figure9: Contentvariability inmanebatthesites

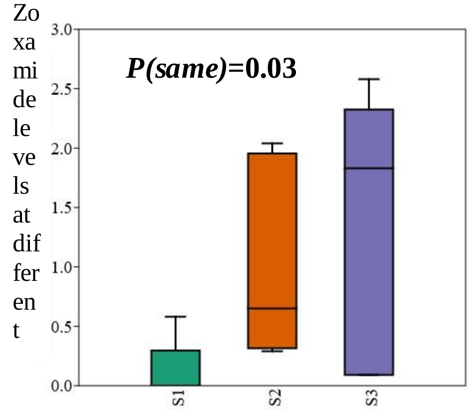

Figure10: Contentvariability inzoxamidein sites

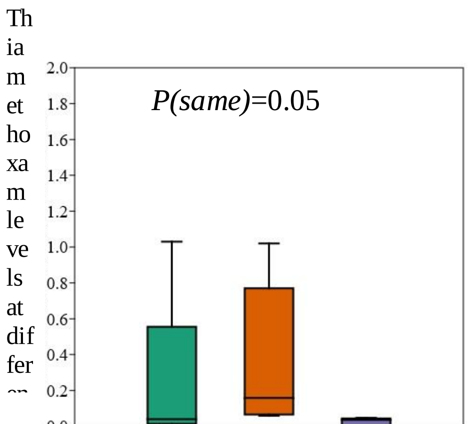

Figure11: Contentvariability inthiamethoxamin sites

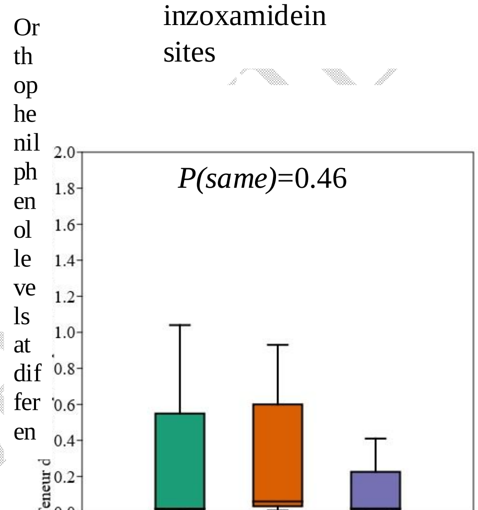

Figure12: Contentvariability inorthophenilphenolatsites

TableIV: ComparisonofactiveingredientlevelswithMRLs

Activeingredients	**Classes**	**MRL (mg/kg)**	**No.ofacceptable samples (%)**	**No.ofunacceptable samples (%)**	**References**
Parathion	Ia	0,05	9(60)	6(40)	
Chlorpyriphos	II	0,05	4(26,67)	11(73,33)	
Dimethoate	II	0,3	8(53,33)	7(46,67)	
Cypermethrin	II	0,7	11(73,33)	4(26,67)	**(EU,2018 ; WHO2019)**
Cyhalothrin	II	0,5	9(60)	6(40)	
Spirodiclofen	III	0,02	3(20)	12(80)	
Orthophenilphenol	NC	0,05	15(100)	0(0)	
Zoxamide	U	30	8(53,33)	7(46,67)	
Thiamethoxam	II	5	15(100)	0(0)	
Chlorothalonil	U	0,3	15(100)	0(0)	
Maneb	U	5	15(100)	0(0)	**WHO,2019**
Carbendazim	II	5	8(53,33)	7(46,67)	
TOTAL			**120(66,67)**	**60(33,33)**	

MRL : MaximumResidue Limit ;**EU :**EuropeanUnion ;**WHO :**WorldHealthOrganization ;**Ia :** extremelyhazardous ;**II :**moderatelyhazardous ;**III :**slightlyhazardous ;**U :**unlikelytopresentan acute hazard ;**NC :**NotClassified and**% :**Percentage.

4. Chemicalrisksassociatedwitheatinglettuce

Chemicalriskassessmentforlettuceconsumptionwascarriedoutaccordingto themethod describedbythe*CodexAlimentarius*Commission**(FAO/WHO,1999)**. Therearerisksof chronicandacuteintoxicationwithParathion,Dimethoate,Chlorpyriphos andSpirodiclofen. TheriskofchronicpoisoningwithParathionis 28%.Ontheotherhand,theriskofacute poisoningis2%.TheriskofchronicpoisoningwithDimethoateis47%.Whiletheriskofacute poisoningis1%.WithChlorpyriphos,theriskofchronicpoisoningis0.3%. Theriskofacute poisoningwithChlorpyriphos is non-existent. Spirodiclofen,ontheotherhand,presents a risk ofchronicandacutepoisoning. These risks are0.22%.The**figures** belowshowthecurves for thechemicalcompounds atrisk.

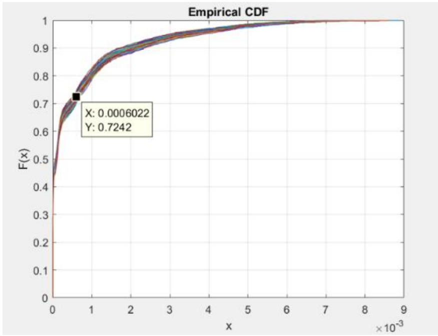

Figure13: Riskofchronicpoisoning with parathion

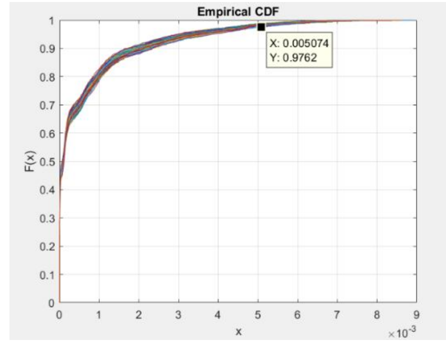

Figure14: Riskof acute poisoning with parathion

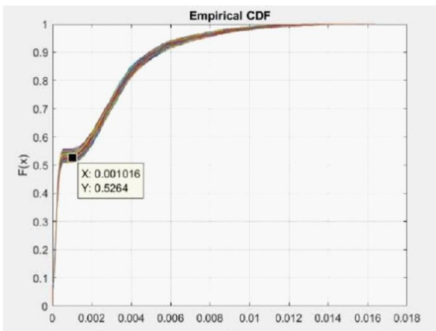

Figure15: Riskofchronicpoisoning withdimethoate

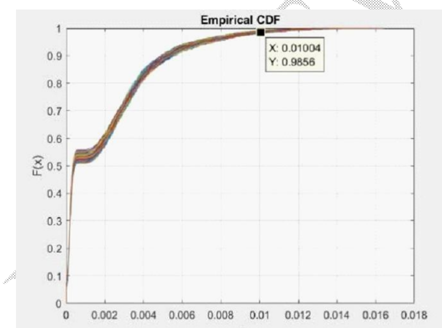

Figure16: Riskofacutepoisoning withdimethoate

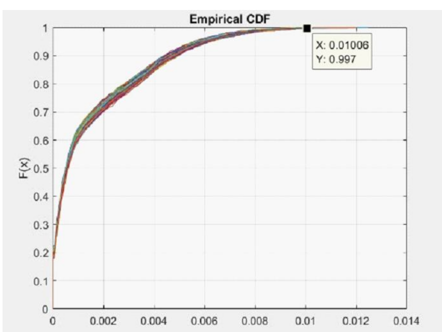

Figure17: Riskofchronicpoisoning withchlorpyrifos

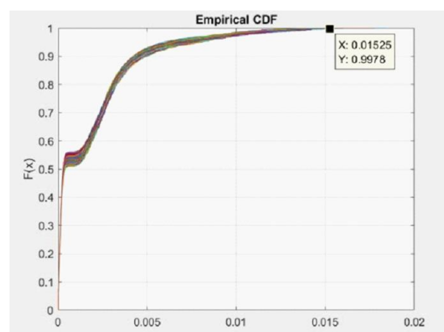

Figure18: Riskofchronicpoisoning andacutewithspirodiclofen

5. DISCUSSION

Urbanagriculture,inparticularlettuceproduction,isundergoingsignificantdevelopmentinthe cityofYamoussoukro.This activityis practicedbybothgenders.However,itisdominatedby men(55.56%)compared towomen(44.44%). Thestrongpresenceofmeninthemarketgardening activityhas beennotedinrecentsimilarstudies onmarketgardening**(Alio*etal.*,2017;Bâ*et al*.,2018;Kouassi*etal.*,2024)**.However,thesedatadifferfromthose reportedby**Kouassi*et al.*(2019)**.Indeed,inastudycarriedoutinDaloa(Côted'Ivoire),theauthorsshowedthaturban lettuceproductionis dominatedbythefemalegenderin58.1%of cases versus 41.9%formen. Thehighinvolvementofmenin thisactivitycouldbeexplainedbytheunavailabilityofland. Thelower-than-averagerateforwomencouldbe linkedtothearduousnature ofthework. Addedtothisisthefactthatwomenare generallyspecializedinmarketingagriculturalcrops **(N'diaye*etal.*,2021)**.Butalso,bythelackoffinancingformarketgardeningactivities. The omnipresenceofseniorcitizens,oreven retirees,seekingadditionalincome andsurelythe arduousnatureofthework (transplantingandirrigation)meanthattheageoftheproducers surveyedisbetween30and60**(*Bâetal.*,2016**).Thisresult differsfromthestudiesby **N'diaye *etal.*(2021)**and**Boukary*etal.*(2023)**onincomedistributionandeconomic growthinsub-SaharanAfricaandonionbulbfarmingpractices.MarketgardeninginYamoussoukroismainly practicedbyIvorians(58.97%).Contrarytothestudiescarriedoutby**Ganacadja*etal.*(2022**), theactivityis predominantlycarriedoutbynon-nationals,witha rateof87.87%. Thehigh involvementofIvoriansinmarketgardeningin Yamoussoukroisduetothefactthattheyare increasinglyinvolvedinthisactivity. Thepercentageofilliterates(82.91%)obtainedinthis studyis higherthanthe70%ofilliteratesreportedby**Kouassi*etal.*** **(2019)**.Thisilliteracyrate canbeexplainedbythe factthatmarketgardeningdoesnotnecessarilyrequire a highlevelof education.However,thelevelofeducationdoes haveanimpactonthemasteryofGood AgriculturalPractices (GAP).

Thegrowerssurveyed(100%)usewaterfromunprotectedwellstowatertheirlettuces. These riskypractices were reportedby**Kouassi *et al.*(2024)**,whoshowedinastudythaturbangrowers usedwellwaterforirrigation.Poultrydroppingsandchemicalfertilizers areusedby respondents (62.39%) as fertilizersinthecityofYamoussoukro. This resultcorroborates those foundby**DeBon*etal.*(2019)**and**Yeo*etal.*(2022)** intheirvariousworkson agroecologicalpracticesandthechallengesofvegetableproductioninCôted'Ivoire.Arateof 37.61%ofurbanlettucegrowersuseamixtureof poultrydroppings,cowdungandchemical fertilizerforbedfertilization.Similarinputswerereportedintheworkof**Boukary*etal.*(2023**), whostatedthaturbangrowers useorganicmanurecombinedwithtwotypes ofchemical fertilizer(NPKandurea). Theuseofthese fertilizers proves thatcultivablesoils arebecoming increasinglynutrient-poor.Allgrowers(100%)usepesticides.Intheworkof**Boukary*etal* (2023),** 74%ofmarketgardeners werealreadyusingpesticides.

The use ofpesticidesbymarket gardeners (100%)in thetown ofYamoussoukro isan unavoidablepractice.Thisresultis contrarytothatfoundby**Oula*etal.*(2021)**.Indeed,the authorsrevealedintheirworkinCôted'Ivoire thattheinappropriateuseofregisteredor unregisteredphytopharmaceuticalproductsiswidespread,reachinga rate of97%amongthe growerssurveyed.Thishighuseofpesticidesbymarketgardenerscanbeexplainedbyrepeated plagueattacksonlettuce.Atleastonepesticideresiduewasfoundinalllettucesamplesfrom thedifferentstudysites.Relativelysimilarpesticideactiveingredientsweredetectedinlettuces fromthecityinvestigated. Thissimilarityindicatesuniformpesticideusepracticesacrossall study sites.Wecanthereforenoticethatgrowerswiththesamedifficultiesexchangeinformation onthesameproductionsite. Awidevarietyofactiveingredientsweredetectedinlettuces. Theseactive ingredients belongtoseveral families,includingOrganophosphates,Pyrethroids, Tetronic Acids,Carbamates,Organochlorines,Dithiocarbamates,Benzamide,Neonicotinoids andphenolsinhighconcentrations.Despitethesimilarities observed,pesticideresiduelevels differfromsitetosite.Organophosphateswere mostabundantinlettuce growninthestudy town.Ourresults areinlinewiththoseof**Saliou*etal*(2013)**.Indeed,inastudyconductedon theevolutionof pesticideresiduesinconsumerhorticulturalproductsinSenegal,theauthors reported the presence ofpesticide residuesbelongingtothe Organophosphorus, Organochlorine,CarbamateandPyrethroidfamilies.Similarly,**AmadouDiop(2013)**reported thepresenceofthesepesticidefamiliesinfruit andvegetables.Residueanalysisofsome pesticidechemicalfamiliesinfruitand vegetableshasalsorevealedthepresenceof OrganophosphatesandOrganochlorines**(Bounesrag,2021)**.Chlorpyrifosand Cypermethrin werealsofoundinfruitandvegetablesinastudycarriedoutin Algeria**(Samira,2017; Rahmani,2019)**. Incontrastwiththeworkof**Yao*etal.*(2016)**,Lambdacyhalothrinwasnot detectedinlettucesfromthestudysites.Parathion,anextremelyhazardousproduct**(EU,2018)**, detectedinlettucesfrom thecityofYamoussoukrowasnotreportedintheworkof**Kpan*etal.* (2019)**.Thediversityof activeingredientsobtainedcouldbeexplainedbythefactthatgrowers use severaltypes of phytosanitaryproducts totreatlettuce.Thedifferent concentrations observedinthesepesticidefamilies canbeexplainedbytheirphysicochemicalproperties.But alsobythequantities of activeingredients appliedbygrowers.

Activeingredientsdeclaredmoderatelyhazardous (II),slightlyhazardous(III)andunlikelyto presentanacutehazard(U)were reportedinourwork**(EU,2018;WHO,2019)**.These results confirmthose reportedby **Oubellil(2022)**intheirworkontheevaluationandcharacterization surveyofpesticides usedinviticultureinAlgeria.

Theactiveingredientsdetectedlettucesfromthetownof Yamoussoukrosometimesexceedthe MRL. Thepresenceofthesecompoundsinlettucescouldhavenegativeconsequencesfor humanandanimalhealth,aswellasfortheenvironment.Arateof33.33%ofsamplesdidnot complywithcurrentEuropeanUnionand WHOstandards.Inotherstudiesonvegetables, especiallylettuce,highratesofnon-compliantsampleshavebeenreported.Thishasbeennoted instudiesonlettuce **(Narenderan*etal.*,2019;Pang*etal.*,2020)**andothervegetables **(Rahman*etal.*, 2021)**.Thesehighlevels of activeingredientscanbe explainedbyoverdosing ofplantprotectionproductsbygrowers. Thiscouldexposeconsumerstotheacute,sub-acute andchroniceffectsassociatedwiththeseproducts.ResiduelevelsbelowMRLs canbe explainedontheonehandbythe lengthoftheperiodbetweenapplicationandsampling,and onthe otherbycompliancewiththe manufacturer'sinstructionspriortoproductapplication **(Ahmad*etal.*,2013;Bakirci*etal.*,2014)**.In ordertoobtain good-qualitylettuces,the useof pesticides onlettucecrops couldbelimited.

Chemicalriskassessmenthasshownthatthereis ariskofchronicandacutepoisoningfrom parathion,dimethoate, chlorpyrifosandspirodiclofen.Infact,28%ofthepopulationwouldbe exposedtochronicpoisoningbyparathionand2%toacutepoisoning.Ontheotherhand,47% ofthe populationwouldbeexposedtochronic intoxicationwithdimethoateand1%toacute intoxication.Inthe caseofchlorpyrifos,only0.3%ofthepopulationwouldbeexposedto chronicpoisoning.On the otherhand,0.22%ofthepopulationwouldbe exposedtochronic andacuteintoxicationwithspirodiclofen.Theresultsobtainedfromthisstudycorroboratethose of**Yao*etal.*(2016)**.Indeed,theauthorsshowedintheirwork thatlettuceconsumersare exposedtothechronicandadverseeffects ofdimethoateandchlorpyrifos. Theadverseeffects ofthesepesticidesonhumanhealtharemanifold. Theseincludedigestive,neurologicaland cardiovasculardisorders,peripheralneuropathiesandpulmonary complications.Butalso dermatological,carcinogenic,reproductiveand endocrineeffects**(Thakur *etal.*,2014)**.

6. CONCLUSION

The study revealed pesticide contamination of urban-grown lettuce in Yamoussoukro, the political capital of Côte d'Ivoire. It revealed that lettuce is produced by illiterate people at a rate of 82.91%. Pesticide residues were detected in the lettuces. These residues belong to nine (9) pesticide families namely organophosphates, pyrethroids, tetronic acids, carbamates, organochlorines, dithiocarbamates, benzamides, neonicotinoids and phenols. Parathion, an extremely hazardous product, was detected in the lettuces produced. A rate of 33.33% of samples did not comply with current standards. The presence of these compounds in lettuces could have negative consequences for human health and the environment. The risks of chronic and acute poisoning linked to the consumption of lettuces are real in the city of Yamoussoukro. Respecting pre-harvest periods could reduce the harmful effects of pesticides on consumers. The relevant authorities need to make growers aware of the harmful effects of pesticides and train them in good farming practices.

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