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Utilization of energy herbage switchgrass production Research progress of fuel ethanol

Xiaohui,Wangyu,Samnang,Wangxiujun,Zhang,Luqianquan,expounding just

(Heilongjiang Provincial Academy of Agricultural Sciences Institute of Biotechnology, Nonporous, Heilongjiang Province, crop and livestock breeding key laboratory,Heilongjiang Harbin150030

Abstract: Energy crop switchgrasscp_ ' CCircleWrgaplusm)low cost of planting,Easy to manage,Short growth period,is highly profitable and has a positive impact on the environmentacts as a hotspot for energy research.nonporous from Switchgrass Energy development features,culture and management way,Biotechnology improvements and BiologyTheresearch progress of energy crop switchgrass is summarized in the fuel conversion process.and biotechnology as the starting point,Biological features for switchgrassdiscusses how to Introduction domestication,Overcoming resistance,makes cellulose effectively degraded,increase the biomass content and yield of ethanol.in theconversion processforbiofuels,optimizing methods for enzymes,thefermentation efficiency of different microorganisms was analyzed,Theconsiders not only the characteristics of microorganisms in simultaneous saccharification and fermentationto consider as an important indicator,Intermittent culture,thecontinuous culture of cell recycling and the selection of fermentation processes such as in situ ethanol removal are also particularly important.

Keywords:switchgrass;Fuel Ethanol;Biotechnology;Ferment

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Biomass energy refers to renewable energies from biological materialssource,can be used to heat,power generation,fuel and production by-products.biotheThree products of energy are ethanol,Biodiesel,biofuels.b,alcohol and biodiesel can be used as fuel and important chemical raw materials.so,Ethanol in the oil based economy to biomass energybased on a sustainable economic and environmentally friendly economy in the transition plays aThe important role.current,Global demand for liquid fuelsgrowing,separating from plants ethanol and biodiesel also withisof concern.

with cellulose and hemicellulose in plant cell walls converted to bAlcohol The increasing cost of this technology,lifting from biomass energy cropsThe potential for renewable energy as a liquid fuel is also gradually being issuedtunneling[1–2].2002year start,biomass energy crop residues intofor Stone focus.United StatesComponentofConservationReserveprogram(CRP))mechanism stone open nonporous[],on2000-year,to grow the same area of Switchgrass(Paw/CDrawWrga-)and Corn(Zeamap),switchgrass output is higher than the corn pathstalkHarvest.through intuitive comparison,Perennial forage energy crops canenough to produce thesame amountof alcohol in the barren marginal land as the grain crop stalks are produced.nonporous from biological characteristics,EnergyDevelopment features,Culture management measures and biotechnology methodsOverview nonporous progress of biomass energy crop switchgrass at home and abroad,provides a theoretical basis for switchgrass follow-up nonporous.

1. Biological characteristics of switchgrass

switchgrass to erect perennial herbsC_4Plant,Its root system is issued

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upto,height up to4.0m,Blade Green Flat,long about(,cm,wideabout1.3cm[5].6-8monthly Blossom,inflorescences Conical,~ ~cmlong,branch End withspikelet[6].seed is light brown,smooth andwith gloss,new harvested seeds with strong hibernate,among varietiesthousand-grain heavy changes greater[~].winter floor dead,Ground floor rootsystem still exists,next year5monthGreen.

switchgrass originated in North America,in a variety of energy crop materialsfilter,switchgrass for high yield,perennial,with soil and water conservation-theforce, and the strong adaptability of poor land, is selectedasthe main for forage crops.The switchgrass can be divided into lowland and highland typesEco type[6],The lowlands are mainly located in the south of the United States,Hi-humidWarm environment,suitable for low latitude areas,four times timeslong(2n=8Xtwo,Highland types are mainly located in the middle and NorthDepartment Area,Hi dry Environment,is suitable for planting in the Gao YanweiRegion,andmostly eight timestimes[8].A variety of switchgrass varieties are planted only inareas similar to those of the "", whereThey originate in close proximity.should be.

2. switchgrass Energy development features

Perennial energy pasture because of its high lignin cellulose content andbecome the main raw material for bioenergy products.vs. Year cropsvs,does not need to sow every year,can grow on barren land,has extremely strong

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Introduction to authors:XiaoHui(1982-,female,Heilongjiang Harbin People,Master,isprimarily engaged inbio-energy crop nonporous.

E-Mail:Xiaohui-333qiotmail.comCommunications Author:expounding justF-mail:Lizhugang@163.com

If you have an efficientNEBThe woody cellulose material of the can beeffectively convert to ethanol,then the maximum output can reachGP(HM^2-°a),second generation ethanol fuel first.so,currentThe first task of the is to build cellulosic bioenergy Refining plusworks.in a variety of bioenergy crops,switchgrass already has potentialto HighNEBcrops[-].

3. cultivation and management of switchgrass

The biomass yield of switchgrass is mainly cultivated by the way,when cultivatedand geographical effects,But seeding mode with biotechnology partyThe method also affects its output[2 0].for different ecological typeswitchgrass need selective planting.Hopkinswait[[]]The indicates the originalThe planting latitude affects switchgrass yields that are planted in different 纟 Vedo.so,at the same time as the improved,take account of its geographic locationPopulation selectivity.Fertilizer Management as well as harvest time factors suchas the ""ring the yield of biomass,These are also directly related to Switchgrasssurvival rate,output,Seed quality and economic recovery[all].plus,These factors are likely to interact with the soil and climate to switchgrassoutput yields ashort-term or long-term effect.

The synergistic effect of genotype and environment on the yield of switchgrass

Important Influence.Hopkinswait[[]]once reported switchgrass smokingspike and yield associated with environment and genotype,and point to headingTheperiod is too early to cause a decrease in output.other,rainy season advance alsocan have a positive effect on a variety,but not significant.genotype-matureto take rootdeep in soil,So you can also get a more in the dry seasonHigh Yield[221 '.

the soil type and the amount of nitrogen fertilizer have important effects on the yield of switchgrassring,soil humidity,Water holding capacity as a factor in yield,especiallyis significantly affected by those drought-tolerant varieties.Research nonporous[~]indicates that,in US Texas,production of switchgrass in severe arid zoneThe height of the plant is significantly affected by the.soil moisture is also commonly usedin conjunction withharvesting frequency or nitrogen fertilizer management factors.ring output.Fikeetc[next]reports,moist soil improves early-maturing varietiesoutput,But for mowing cropping systems,wet soil to yieldChange not noticeable.Stoutetc[[]]The nonporous of the indicates that,whenWhen precipitation is scarce,soil water Holding capacity limits production,herewhen,nitrogen is the

primary factor affecting switchgrass production.Vogelwait[[]andMulkey, and so on[a]The experiment with also proves that,when the amount of nitrogen fertilizer is applied by thekg/HM^{2}tokg/HM^2,switchgrass yield increase 28%.CRPproject[]RecommendationsA-kg/HM^{2}is a valid amount,but also needto be adjusted for different locations,Environment Change.

4. Biotechnology method improved Switchgrass

New and reliable biotechnology methods for reducing bioenergy intocan play a vital role,especially for wood fibersto produce ethanol crops for raw materials.Core issues include introduction ofTraining "",Overcoming resistance,Effective degradation of cellulose,Increase biomass contentand ethanol yield[.

4.1 Modification of lignin biosynthesis reduces quality ofligninSynthetic can improve saccharification efficiency[3 0].currently nonporous tableMing,has2The method can be decorated with lignin.First,assimilationlignin structure.lignin content is as important as structure,evenInteraction between,in lignin fractionation processfull,But a more consistent lignin structure can be beneficial to the cell wall.degrade,Toefficiently produce fuel ethanol.Second,If cellulose containsvolume below threshold range,preprocessing can omit,to addsaccharification of strong downstream enzymes and increased fermentation efficiency[a].so,Lignin-Modified switchgrass can improve the efficiency of converting biomass tofermented sugars.

4.2 The pros and cons of abiotic stress resistant water quality and otherSome abiotic stresses can limit biomass production,so,Stress-resistantfor switchgrass to grow on marginal land where crops cannot be grownThe more important the nature of the response is the.drought,Heavy Metal,Salt,cold andthermal coercion triggers a crop response,and each coercion alsocauses different genetic changes[%].saline-alkali,Drought-resistant upstream channelalready in Arabidopsis thalianaWaM)Medium good surfaceup out[~Panax notoginseng.but,only limited GMO sofarThe experiment made the crop successfully exhibit abiotic stress adaptability.

Research on abiotic stress resistance of energy crops should be twoTheaspect startswith.first,differentcrop genotypes should not be limitedin laboratory research nonporous,also field experiment,All of these will be fertilethe basicsof genetic engineering.actually,switchgrass in cultivationthedifferent tables in the process have been shown for water quality and cold conditionsbullying.But plants for water quality,chilling injury and salt resistance tableShowComplex Comprehensive physiological responses,same as different species or same kindThe variety often shows great differences,Eventhe resistance of the same breed to the inversewill vary with the growth period..so forswitchgrass abiotic stress resistant nonporous should be combined with different varieties,does notMultiple forms in fertility and different soil conditions,Physiological PointMark and agronomic characters for identification[+' = _ '.second,for schema productsBasic research application of species in field crops,mode varieties confirmThe critical stress response gene for the should be applied through the gene modification to switchgrassEnergycrops.

4.3 ways to increase production and biomass energy generation

First,should be accurate in the molecular mechanism that controls crop architecture.Understanding.for current field studies can be converted to bioenergyThe material architecture features changes in the study.For example,through moleculeBiotechnology means getting short stalks,Vertical crops,toraise the yieldamount.another,through the modification of the cell wall biosynthesis gene and theThe enzyme modification can also increase biomass productivity.cellulose synthesized overdegreeswill correspondingly improve the biosynthesis of lignocellulose[4 0].The generation of biomass energy can also be improved by the hormone response base for cropsby Cosmeticthe[41_44].

5. converting switchgrass to biofuels nonporous

comes from a wood,Pasture and agricultural or forestry wasteethanol fuel produced by lignocellulose in as transport fuelGreatly reduced human dependence on gasoline imports,simultaneous decreaseImbalancesin the trade deficit,improves city air quality,reduceout of the atmosphere$C0_2$pollution caused by,and provides a boost toNew Market for agricultural economy.simultaneous saccharification and fermentation[/]nowinpreferred way to convert

lignocellulose biomass to ethanol fuelmethod,This method increases the conversion rate of energy and the yield of ethanol,Thealso lowers the cost of concentrated ethanol.

Thehydrolysis of cellulose in lignocellulose biomass raw material can make sugarclass degradation for further fermentation to produce ethanol.in currentferment technology,the cost of producing ethanol from lignocellulose is relatively lower thanhigh,yield lower,and the hydrolysis process is much more expensive.current massexperiments are devoted to improving the hydrolysis process of lignocellulose raw materials.inpreprocessing procedure,Remove hemicellulose from ligninPromote hydrolysis of cellulose.optimization of cellulase and enzyme negativeload also improves hydrolysis process.Synchronous saccharification can effectivelyremove theinhibition of cellulose activity by the in addition to glucose, toIncrease ethanolyield and accelerate cellulose hydrolysis efficiency[+].

Microbial,The fermentation efficiency of the yeast and fungi is mainly manifested intheIts inhibition of hydrolysis of lignocellulose.Wood cellulosedifferent hydrolysis type,The inhibitor component changes accordingly,The result of microbial fermentation isdifferent..restricting microbial fermentationparameters,such aspHvalue,temperature and nutrients should be in the process of fermentation tobe considered.in fermentation engineering,not only microbial characteristics to be donefor important metrics consider,such as intermittent culture,Sequential for cell recyclingculture and the selection of fermentation processes such as in-situ ethanol removal are also particularlyImportant critical[all].

6. Conclusion and Outlook

The future of bioenergy is looking for more technical breakthroughs.varioussuch as cell wall biosynthesis,product metabolism and other genetic research nonporous and pathway researchTheReview should be taken more seriously as a fundamental study..for biofuelstheapplication of the requires help from the Bio-translation system."Group"technology toBase of cell wall structure and features corresponding to different stages of developmentreason,protein and metabolic Research nonporous have a guiding role,can help inOne step to improve the adaptability of raw material seeds.

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