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DIZELSKA GORIVA U POLJOPRIVREDI

Sažetak

Europske direktive o kvaliteti motornih goriva daju određena ograničenja kvalitete, s namjerom zaštite okoliša. Glavni nepoželjni sastojci goriva su benzen, ukupni aromati, policiklički aromati, olefini, sumpor, čijim izgaranjem u motoru trošila nastaju komponente plinova štetne za okoliš.

U posljednjih dvadeset godina količina sumpora u dizelskim gorivima smanjena je šezdeset puta, kako su zahtijevale europske norme EN 590. Današnja razina sumpora od 50 mg/kg nije ona konačno zahtijevana, već će od 01.01.2009. biti 10 mg/kg, što se smatra da je gorivo bez sumpora. Smanjenje sumpora u motornim gorivima je najjednostavniji način za smanjenje emisije zagađivača iz čitavog voznog parka, iako nedovoljno samo po sebi. Sumpor neznatno utječe na kemijski sastav ispušnih plinova u odnosu na stvaranje krutih sulfatnih čestica. Najveće njegovo štetno djelovanje je izraženo u svojstvu trovača katalizatora u sustavima za obradbu ispušnih plinova i dijagnostičkim sustavima procesa izgaranja. Ovakva je situacija kod svih motornih vozila, bez obzira na vrstu motora.

Strojevi u poljoprivredi nemaju sustave za obradbu ispušnih plinova, pa se kontrola zagađenja odvija uglavnom ograničenjem količine sumpora u gorivu. Europske direktive, između ostalog, upućuju članice EU i na osiguranje određene količine goriva s manjim sadržajem sumpora za poljoprivredne strojeve na njihovom teritoriju, u određenom vremenu. Iz učinjene analize direktiva i norma EU, HR norma i uredbi, zakona, pravilnika o gorivima i uputama proizvođača poljoprivrednih strojeva postavljeni su kriteriji za odabir potrebne kvalitete goriva na hrvatskom tržištu, za određeni tip trošila, a potom su dane preporuke, uz zaključak. S obzirom na pretpristupne pregovore oko ulaska Republike Hrvatske u sastav EU, osobito u segmentu poljoprivrede i utjecaja na okoliš, vrlo je bitno ovo ugraditi u zakonsku regulativu na primjeren način.

Uvod

Poticaj ovom radu bio je ciklus predavanja održan za poljoprivrednike u Hrvatskoj na temu Motorna goriva u poljoprivredi u zimi 2005. godine, a u okviru edukacijskog programa koji je realiziran u suradnji s Hrvatskim zavodom za poljoprivrednu savjetodavnu službu HZPSS pri Ministarstvu poljoprivrede, šumarstva, vodnog gospodarstva i INE. Nakon provedene ankete i razgovora, učinjena je analiza problema, predložena su rješenja i podnesena su izvješća. Uočeno je nedovoljno poznavanje goriva koja se koriste u motorima za obavljanje poljoprivrednih poslova, u svim fazama i na svim razinama. Cilj je ovog rada ukazati na problematične točke i uzroke koji dovode do nedovoljno racionalnog korištenja goriva, dajući obrazloženja, i preporuke za pravilan odabir.

Analiza dokumentacije

Analizom dokumentacije, kao što su EU direktive, uredbe, zakoni, pravilnici, norme i upute proizvođača traktora, bilo je obuhvaćeno sedam tipova traktora, različitih podtipova zastupljenih na području Republike Hrvatske (tablica 1).

Tablica 1: Analiza preporuka goriva po proizvođaču traktora

	Tip traktora/godina	Gorivo/sumpor, ppm			Napomena
		Po proizvođaču motora	Na hrvatskom tržištu	Prijedlog	
1.	FENDT/1998. engl.	-Dizel do 5000 ppm (mg/kg) S -<50 ppm (mg/kg) koristiti aditiv za mazivost	-Dizel 5000 -Eurodizel 50	-Dizel 5000 -Eurodizel 50	Biodizel, konzultirati servis. Zamjena ulja 2x češća uz biodizel i dizel S preko 5000 ppm (mg/kg)
2	FERGUSON, 6200, 12/1999. hrv.	-Eurodizel, <0,5 % S D2 ASTM 975 D1 (?) za hladno vrijeme NE spominje CB (cetanski broj)	-Dizel 5000 -Eurodizel 50	-Dizel 5000 -Eurodizel 50	EN 590/1999, S=500 ppm v.s. ASTM D 975, S=5000 ppm (mg/kg). Preporuča se S manje od 5000 ppm (mg/kg). Konzultirati proizvođača.
3.	NEW HOLAND TM120, TM130, TM140, TM155, TM175, TM190, hrv.	1-D } S=5000 ppm (mg/kg) 2-D Ne navodi ASTM	-Dizel 5000	-Dizel 5000 ppmS	Ne spominje ASTM 975 niti EN 590
4.	CASE MXM120, MXM130, MXM140, MXM155, MXM175, MXM190/2002 hrv.	1-D } S=5000 ppm (mg/kg) 2-D Ne navodi ASTM	-Dizel 5000	-Dizel 5000 ppmS	Ne spominje ASTM 975 niti EN 590
5.	STEYR/M9078, M9078a, M9086a, M9094a 1998. hrv.	-EN 590/1996 s postojećim ND -Biodizel, može -Jednoznačni u navodu norme	-Eurodizel 50	-Eurodizel 50	Ne preporuča se biodizel, daju naputak za petrolej. Piše da se može pogoniti na EN 590. Tada je bio EN 590/1996, S=500 ppm (mg/kg)
6.	FERGUSON, 1106 C/? engl.	-EN 590? S<50 ppm (mg/kg) -preporuča se CB min 51 -voda 200 mg/l	-Eurodizel 50 CB min 51	-Eurodizel 50	EN 590 v.s. ASTM D 975 1-D S=5000 ppm (mg/kg) CB 51 uvjetuje da je predložen Eurodizel
7.	JOHN DEERE, 6020, 6120, 6220, 6320, 6420, 6420 S/2001 hrv.	-EN 590? -ASTM 975 <0,05 % S CB min 40, preporuča se >50 -S<500 ppm (mg/kg)	-Dizel 5000 -Eurodizel 50	-Eurodizel 50 -Dizel 5000	EN 590 preporuča se i S manje od 500 ppm (mg/kg); tj. ASTM D 975 -S>5000 ppm (mg/kg) 2X češća zamjena ulja -min CB je zadovoljan dizelom

Proizvođači traktora i njihovi distributeri u svojim uputama, u dijelu koji govori o potrebnoj razini kvalitete goriva, nisu potpuno jasni niti određeni. Kod navoda norme EN 590 ne zna se godina izdanja norme, koriste se oznake goriva, a da se ne navodi norma (ASTM), samo se govori o 1-D i 2-D. Osobito se to odnosi na prevedene upute, u kojima se nekorektno zamjenjuju oznake za dizelsko gorivo u RH iz prošlih vremena (D2) s onom koju definira ASTM D 975, 2-D (tablica 2).

Tablica 2: Značajke dizelskih goriva ASTM D 975 v.s. HRN EN 590/1999

Osobina	ASTM D 975, N_0 1-D	ASTM D 975, N_0 2-D	Dizel/Eurodizel plavi (D2)	Eurodizel	Napomena
Plamište ^{0}C, min	38	52	55	55	
Voda i sedimenti, % vol, maks.	0,05	0,05	-	-	
Voda,% vol, maks.	-	-	0,035	0,02	
Kinematička viskoznost, mm^2/s, 40 ^{0}C	1,3-2,4	1,9-4,1	2-4,5	2-4,5	
Sumpor, % mas., mg/kg	0,50 5000	0,50 5000	0,50 5000	0,005 50	od 01.01.09. 10 ppm (mg/kg)
Cetanski broj, min.	40	40	-	51	
Cetanski indeks	40	40	46	46	

ASTM D 975 definira dvije gradacije 1-D i 2-D:niski sumpor s 500 ppm (mg/kg)sumpor s 5000 ppm (mg/kg).

Razjašnjeni su sporni i nejasni naputci.

Kod postavljanja kriterija za odabir goriva trebalo je uzeti u obzir da ASTM D 975 definira dvije gradacije dizelskog goriva: 1-D i 2-D, i to:

- niski sumpor, 500 ppm (mg/kg)
- sumpor, 5000 ppm (mg/kg)

Kriterij za odabir goriva

1. S obzirom da se u tehničkoj dokumentaciji nigdje ne navodi za 1-D i 2-D niski sumpor (500 ppm), podrazumijeva se gorivo s 5000 ppm (mg/kg) sumpora.

2.Uz EN 590 bez navoda godine, a gdje se spominje i ASTM D 975, 1-D i 2-D, predlaže se dizelsko gorivo s većim sadržajem sumpora, 5000 ppm (mg/kg).

3. Preporuka za cetanskim brojem se uvažava.

Diskusija

Analizom su utvrđeni uzroci silnih nejasnoća i nesporazuma, a to su:

- prevoditelji nemaju dovoljno znanja o gorivu,
- nedovoljna je edukacija korisnika poljoprivrednih strojeva,
- nekompetentnost savjetodavaca o gorivu,

- nelogično nazivlje goriva za poljoprivredu.

Nelogičnost nazivlja se očituje u tome što bi se logikom moglo zaključiti da je Eurodizel – plavi dobiven bojanjem niskosumpornog (50 ppm) Eurodizela, što nije istina, već je boja dodana u dizel s 5000 ppm (mg/kg) sumpora (tablica 3).

Tablica 3: Asortiman dizelskih goriva u Hrvatskoj

Asortiman	Sumpor, mg/kg	
	do 2005.	od 2005.
Dizel	5000	5000
Eurodizel-plavi	5000	5000
Eurodizel	350	50
Asortiman neizmijenjen u prvom dijelu 2006.		

U međuvremenu je došlo do kvalitativne promjene asortimana dizelskih goriva na hrvatskom tržištu, što je regulirano relevantnim dokumentima. Eurodizel se proizvodi s 50 mg/kg sumpora, a prethodno je sadržavao 350 mg/kg. U ovom dijelu Dizel i Eurodizel-plavi nisu doživjeli promjene. Za razliku od prethodnog razdoblja, sada su razredi niskotemperaturne osobine točka filtrabilnosti CFPP (A, B i C) i vremensko razdoblje njihova trajanja isti za sva tri goriva, što se smatra poboljšanjem u primjenskom i praktičnom smislu (tablica 4).

Tablica 4: Značajke dizelskih goriva u Hrvatskoj

Značajke	Eurodizel	Dizel	Eurodizel-plavi
Gustoća, kg/m^3	820-845	820-860	820-860
Količina ukupnog sumpora, mg/kg, maks.	**50**	**5000**	**5000**
Cetanski broj, min.	51	-	-
Cetanski indeks, min.	46	46	46
Točka filtrabilnosti CFPP ^{0}C, maks.			
Klasa B, 0 ^{0}C	16.4-30.9	16.4-30.9	16.4-30.9
D, -10 ^{0}C	**01.10.-15.11.**	**01.10.-15.11.**	**01.10.-15.11.**
	01.03.-15.04.	**01.03.-15.04.**	**01.03.-15.04.**
E, -15 ^{0}C	16.11.-29.02.	16.11.-29.02.	16.11.-29.02.
Mazivost HFRR, µm, maks.	**460**		

Posljedica svega ovoga jest:

1. Nepriznavanje reklamacije u jamstvenom roku:

ako se ne koristi D2 (ne postoji na tržištu pod tim imenom, a kvalitetom odgovara Dizelu i Eurodizelu-plavom)

ako se koristi Eurodizel-plavi (a jednake je kvalitete kao i bivši D2)

2. Zbunjenost korisnika, osobito vlasnika traktora novije generacije

3. Dodatno smanjeno iskorištenje strojeva zbog loše kvalitete goriva izazvane namjerom pojedinca – nedopuštenim miješanjem, bolje rečeno «muljanjem» ili uvozom goriva koje ne odgovara definiranoj kvaliteti.

Od analiziranih tipova traktora Steyr je jedini jednoznačan u navodu kvalitete goriva, EN 590/ 1996, iako se o godini moglo zaključilti po datumu izdavanja dokumentacije, 1998. Tada se europskom normom ograničavao sumpor u dizelskom gorivu na maksimalno 500 ppm (mg/kg), što je u trenutku analiziranja dokumentacije (2005) odgovaralo Eurodizelu u Hrvatskoj, koji je u to vrijeme sadržavao 350 ppm (mg/kg), a danas 50 ppm (mg/kg). Ferguson 1106 C i John Deere preporučuju vrijednost cetanskog broja dizelskom gorivu minimalno 51 i maksimalno dopuštenu količinu vode 200 mg/l, što uvjetuje korištenje Eurodizela na hrvatskom tržištu (tablica 1).

Traktori izvan jamstvenog roka mogu koristiti dizelsko gorivo do 5000 ppm (mg/kg) sumpora (Dizel), bez opasnosti za motor. Količina sumpora iznad 5000 ppm (mg/kg) u gorivu za traktore jedino uzrokuje prepolovljeni interval zamjene ulja i utječe na povećani sadržaj krutih čestica (sulfati) u ispušnim plinovima trošila. Goriva s količinom sumpora preko 5000 ppm (mg/kg) u RH nema. Veliki broj osobnih automobila i kamiona u Hrvatskoj troši dizelsko gorivo do 5000 ppm (mg/kg) sumpora. Traktori nemaju dodatni sustav za obradu ispušnih plinova, kojem bi smetao sumpor. Neracionalno je trošiti niskosumporno gorivo na traktorima kojima to nije uvjet.

Europske direktive postavljaju određena ekološka ograničenja kvalitete goriva zbog zaštite okoliša. Najjednostavnija metoda smanjenja emisije štetnih sastojaka iz cjelokupnog voznog parka je smanjenje sumpora u gorivu, a sustavi za obradu ispušnih plinova i dijagnostički sustavi izgaranja u motoru, na čiju učinkovitost sumpor djeluje negativno, dodatno smanjuju količinu štetnih sastojaka.

Kod poljoprivrednih strojeva kontrola zagađenja okoliša odvija se uglavnom smanjenjem količine sumpora u gorivu.

Tablica 5: EC direktive 2003/17/EC

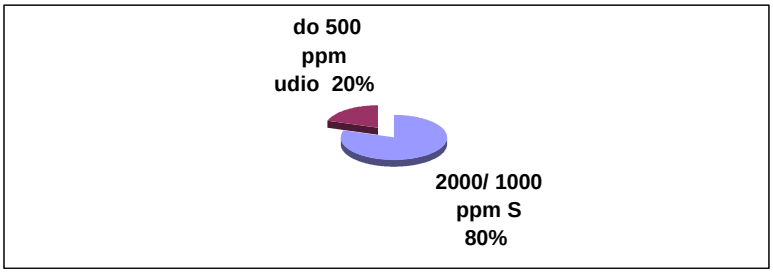
Direktiva 2003/17/EC, poboljšanje 98/70/EC, amandman čl. 4(b)		
Članice EU moraju osigurati na svom području plinsko ulje za šumarske i poljoprivredne strojeve		
godina	**do 2008.**	**od 01.01.2008.**
količina sumpora, mg/kg	**2000** $\Rightarrow$ ***Uredba o kakvoći TNG***	**1000 i manje ili kao dizel**

Direktiva 2003/17/EC, poboljšanje Direktive 98/70/EC relating to the quality of petrol and diesel fuels donosi amandmane, uzimajući u obzir niz prije utvrđenih obveza, navodeći i one bitne za poljoprivredne strojeve. Ukazuje se na direktive koje govore o emisiji plinova i čestica iz poljoprivrednih i šumskih traktora i necestovnih vozila, i kvaliteti goriva, kako bi se osigurao «monitoring» u okviru nacionalnog sustava.

Tako amandman 4(b) upućuje članice (EU), između ostalog, i na osiguranje određene količine plinskog ulja na svom teritoriju za necestovna vozila, poljoprivredne i šumske traktore sa sadržajem sumpora manje od 2000 mg/kg. Od 01.01.2008. plinska ulja za takve strojeve smiju imati do 1000 mg/kg sumpora, a može i manje, ili kao i dizelsko gorivo (tablica 5).

U ukupnoj populaciji traktora u Hrvatskoj je oko 20 % onih koji trebaju koristiti dizelsko gorivo sa smanjenim sadržajem sumpora, a to je na našem tržištu Eurodizel (slika 1).

Slika 1: Udio traktora u korištenju pojedine kvalitete goriva
Figure 1: Share of tractors in the use of individual fuel quality types



/ up to 500 ppm, share: 20% /

- Eurodizel (50 mg/kg) u RH / *Eurodizel* (50 mg/kg) in Croatia
- Tržište je osiguralo niskosumporno gorivo / The market has ensured low sulphur fuel
- Država treba regulirati njegovo povlašteno korištenje / The state should regulate its privileged use

Zaključci

1. U Hrvatskoj se nedovoljno posvećuje pažnja gorivima za poljoprivredne strojeve, šumske traktore i necestovna vozila u svim segmentima:
   - zakonodavnim odredbama,
   - stručnom prevođenju uputa za korištenje odgovarajućeg goriva,
   - stručnoj edukaciji korisnika,
   - kvaliteti goriva,
   - kontroli kvalitete.
2. Hrvatsko tržište je osiguralo potrebnu kvalitetu goriva s manje od 500 mg/kg sumpora, a država treba regulirati njegovo povlašteno korištenje, u količini oko 20 % od sveukupnih potreba za traktore u poljoprivredi.
3. Na hrvatskom tržištu je potrebno osigurati niskosumporno dizelsko gorivo za poljoprivredne strojeve s manje od 2000 mg/kg, a od 01.01.2008. s maksimalnom količinom od 1000 mg/kg sumpora.

DIESEL FUELS IN AGRICULTURE

Abstract

European directives on the quality of motor fuels impose certain quality limitations, for the purpose of environmental protection. The principal undesired fuel components are benzene, total aromatics, polycyclic aromatics, olefins, sulphur – whose engine combustion generates environmentally harmful exhaust gas components.

Over the past twenty years, the amount of sulphur in diesel fuel was reduced for about sixty times, as required by the European standard EN 590. Today's sulphur level of 50 mg/kg is not the one ultimately required, but, as of 01/01/2009/, it shall be 10 mg/kg, which is considered as sulphur-free fuel.

Reduction of sulphur in motor fuels is the simplest way of reducing pollutant emission of the entire vehicle pool, although in itself still insufficient. Sulphur has a slight impact on the chemical composition of exhaust gases with regard to the generation of solid sulphate particles. Its greatest harmful impact consists in rendering catalytic converters in the systems for treating exhaust gases and diagnostic systems of the combustion process. Such a situation is true of all motor vehicles, regardless of the engine type.

Agricultural machinery does not have exhaust gas treatment systems, so that pollution control proceeds mostly through the limitation of the fuel sulphur content. European directives advise the EU members, among other things, to ensure a certain volume of fuel with reduced sulphur content for agricultural machinery on their territory, over a given period of time. From the implemented analysis of EU directives and standards, HR standards and regulations, acts, books of rules on fuels and instructions of agricultural machinery manufacturers, criteria have been set for chosing the necessary fuel quality on Croatian market, for a given type of consuming devices, followed by recommendations and conclusions. Given the preliminary negotiations of Croatia's joining of the EU, especially in the segment of agriculture and ecology, it is of an outmost importance to incorporate it adequately and timely into legal regulations.

Introduction

The incentive for writing the present paper has been a series of lectures for agriculturists held in Croatia in the winter of 2005 on the subject of Motor Fuels in Agriculture, as a part of the educational program undertaken in co-operation with the Ministry of Agriculture, Forestry, Water Management and INA. After the poll and the

talks, an analysis of the issue was performed, solutions suggested, and reports submitted. It has been established that there is an unsufficient knowledge of the fuels used in agricultural machinery engines, in all phases and at all levels. The purpose of the paper is to indicate problematic items and causes leading to insufficiently rational fuel use, by providing explanations and recommendations for a proper choice.

Analysis of Documentation

An analysis of documentation, such as EU directives, regulations, acts, books of rules, standards, and tractor manufacturer guidelines, has involved seven types of tractors, of various sub-types, represented on the territory of Croatia (Table 1).

Table 1: Analysis of fuel recommendations per tractor manufacturers

	Tractor type/year	Fuel/sulphur, ppm (mg/kg)			Note
		Per engine manufacturer	On Croatian market	Proposal	
1.	FENDT/1998. Engl.	-Diesel up to 5000 ppm (mg/kg) S -<50 ppm (mg/kg) use lubricity additive	-Dizel 5000 -Eurodizel 50	-Dizel 5000 -Eurodizel 50	Biodiesel, consult servicing. Oil fill interval 2x more frequent with biodiesel and diesel S over 5000 ppm
2.	FERGUSON, 6200, 12/1999. Croat.	-Eurodiesel, <0.5 % S D2 ASTM 975 D1 (?) for cold weather DOES NOT mention CB	-Dizel 5000 -Eurodizel 50	-Dizel 5000 -Eurodizel 50	EN 590/1999, S=500 ppm v.s. ASTM D 975, S=5000 ppm. Recommended S below 5000 ppm. Consult manufacturer.
3.	NEW HOLAND TM120, TM130, TM140, TM155, TM175, TM190, Croat.	1-D } S=5000 ppm (mg/kg) 2-D Does not mention ASTM	-Dizel 5000	-Dizel 5000 ppm (mg/kg) S	Does not mention ASTM 975 or EN 590
4.	CASE MXM120, MXM130, MXM140, MXM155, MXM175, MXM190/2002 Croat.	1-D } S=5000 ppm (mg/kg) 2-D Does not mention ASTM	-Dizel 5000	-Dizel 5000 ppm (mg/kg) S	Does not mention ASTM 975 or EN 590
5.	STEYR/M9078, M9078a, M9086a, M9094a 1998. Croat.	-EN 590/1996 with existing ND -Biodiesel OK -Exclusive in standard indication	-Eurodizel 50	-Eurodizel 50	Biodiesel not recommended, guidelines mention paraffin. Indicated drive EN 590. Valid at the time was EN 590/1996, S=500 ppm (mg/kg)
6.	FERGUSON, 1106 C/? Engl.	-EN 590? S<50 ppm (mg/kg) -recommended CB min 51 -water 200 mg/l	-Eurodizel 50 CB min 51	-Eurodizel 50	EN 590 v.s. ASTM D 975 1-D S=5000 ppm (mg/kg) CB 51 conditions Eurodiesel proposal
7.	JOHN DEERE, 6020, 6120, 6220, 6320, 6420, 6420 S/2001 Croat.	-EN 590? -ASTM 975 <0.05 % S CB min 40, recommended >50 -S<500 ppm (mg/kg)	-Dizel 5000 -Eurodizel 50	-Eurodizel 50 -Dizel 5000	EN 590 recommended; S less than 500 ppm (mg/kg); i.e. ASTM D 975 -S>5000 ppm (mg/kg) 2X more frequent oil fill intervals -min CB satisfied with diesel fuel

Tractor manufacturers and their distributors are not entirely clear or specific in their guidelines, in the part indicating the necessary fuel quality level. While listing the standard EN 590, we do not know the year of its issuing; fuel labels are used without mentioning the standard (ASTM), only 1-D and 2-D are mentioned. This particularly refers to translated guidelines, in which there is an incorrect replacement of the

diesel fuel labels in Croatia from before (D2) with the one set by ASTM D 975, 2-D (Table 2).

Table 2: Properties of diesel fuels ASTM D 975 v.s. HRN EN 590/1999

Property	ASTM D 975, N_0 1-D	ASTM D 975, N_0 2-D	Diesel fuel (D2)	Eurodizel	Note
Flash point ^{0}C, min	38	52	55	55	
Water and sediments, % vol, max.	0,05	0,05	-	-	
Water,% vol, max.	-	-	0,035	0,02	
Kinematic viscosity, mm^2/s, 40 ^{0}C	1,3-2,4	1,9-4,1	2-4,5	2-4,5	
Sulphur, % mas., mg/kg	0,50 5000	0,50 5000	0,50 5000	0,005 50	as of 01/01/09 10 ppm
Cetane number, min.	40	40	-	51	
Cetane index	40	40	46	46	

ASTM D 975 sets two grades 1-D i 2-D: low sulphur with 500 ppm sulphur with 5000 ppm.

The controversial and ambiguous guidelines have been cleared.

When establishing criteria for the choice of fuels, it was necessary to take into account that ASTM D 975 sets two grades of diesel fuel: 1-D and 2-D, as follows:

- low sulphur, 500 ppm
- sulphur, 5000 ppm

The Criterion for Choosing the Fuel

1. Given that the technical documentation never lists low sulphur for 1-D and 2-D (500 ppm), it goes without saying that it refers to fuel with 5000 ppm of sulphur.

2. With EN 590 without year indication, where ASTM D 975, 1-D i 2-D, is also mentioned, it is suggested to use diesel fuel with higher sulphur content, 5000 ppm.

3. Recommendation for the cetane number is accepted.

Discussion

An analysis has established the causes of numerous unclarities and misunderstandings, as follows:

- translators do not have sufficient knowledge about fuel,
- insufficient education of agricultural machinery users,
- incompetence of fuel advisors,
- illogical names of agricultural fuels.

Illogical names refer to the fact that it could be concluded from them that e.g. the fuel called *Eurodizel – plavi* was obtained by dyeing low sulphur - 50 ppm (mg/kg) *Eurodizel*, which is not the case, but rather dye was added to diesel fuel with 5000 ppm (mg/kg) of sulphur (Table 3).

Table 3: Assortment of diesel fuels in Croatia

Assortment	Sulphur, ppm (mg/kg)	
	up to 2005	as of 2005
Diesel Fuel	5000	5000
Eurodizel-plavi	5000	5000
Eurodizel	350	50
Assortment unchanged in the first part of 2006		

In the meantime, there has been a qualitative change of the diesel fuel assortment on Croatian market, duly regulated by relevant documents. *Eurodizel* is produced with 50 mg/kg of sulphur, while before it used to contain 350 mg/kg. In this part, *Dizel* and *Eurodizel-plavi* did not sustain any changes. Unlike the previous period, now the classes of low temperature property called cold filter plugging point (A, B i C) and their duration are the same for all the three fuels, which is considered to be an improvement in both performance-related and practical terms (Table 4).

Table 4: Diesel fuel properties in Croatia

Properties	Eurodizel	Dizel	Eurodizel-plavi
Density, kg/m^3	820-845	820-860	820-860
Total sulphur, mg/kg, max.	**50**	**5000**	**5000**
Cetane no, min.	51	-	-
Cetane index, min.	46	46	46
Filtrability CFPP ^{0}C, max.			
Class B, 0 ^{0}C	16/4-30/9	16/4-30/9	16/4-30/9
D, -10 ^{0}C	**01/10-15/11**	**01/10-15/11**	**01/10-15/11**
	01/03-15/04	**01/03-15/04**	**01/03-15/04**
E, -15 ^{0}C	16/11-29/02	16/11-29/02	16/11-29/02
Lubricity HFRR, µm, max.	**460**		

All this results in the following:

1. Unacknowledged complaints within the warranty period:
   - if D2 is not used (there is no fuel with that name on the market, while the quality matches that of *Dizel* and *Eurodizel-plavi*)
   - if *Eurodizel- plavi* is used (matching the quality of the former D2)
2. Confused consumers, especially owners of the new generation tractors
3. Additionally reduced machinery utilization due to poor fuel quality caused by individual intentions – unauthorized blending, or importing fuel not matching the set quality level.

Out of the analyzed tractor types, only Steyr is completely unambiguous in indicating fuel quality: EN 590/1996, although the year was only derivable from the date of documentation issuing, 1998. At the time, a Europen standard was limiting the diesel

fuel sulphur content down to max. 500 ppm, which – at the moment of analyzing documentation (2005) – was matching *Eurodizel* in Croatia, containing, at the time, 350 ppm, and today, 50 ppm. *Ferguson 1106 C* and *John Deere* recommend cetane number value in diesel fuel to be min. 51 and max. permissible water level of 200 mg/l, necessitating the use of *Eurodizel* on Croatian market (Table 1).
Tractors with expired warranty periods may use diesel fuel with up to 5000 ppm of sulphur (diesel fuel), without any threat to the engine. Sulphur level above 5000 ppm in tractor fuel causes only a two times shorter oil fill interval and impacts increased solid particles (sulphates) content in the exhaust gas. There are no fuels with sulphur level over 5000 ppm in Croatia. A number of passenger vehicles and trucks in Croatia consumes diesel fuel up to 5000 ppm of sulphur. Tractors do not have an additional exhaust gas treatment system which would find sulphur harmful. It is uneconomical to waste low sulphur fuel to tractors that may easily use other types of fuel as well.

Table 5: EC directives 2003/17/EC

Directive 2003/17/EC, improvement 98/70/EC, ammendment art. 4(b)		
EU members must ensure on their territory gas oil for forestry and agricultural machinery		
Year	***up to 2008***	***as of 01/01/2008***
Sulphur content, mg/kg	**2000** ⇒ ***Directive on Quality TNG***	***1000 and less or as diesel fuel***

European directives set certain environmental limitations to fuel quality in view of environmental protection. The simplest method of reducing the emission of harmful components of the entire vehicle pool is the reduction of the fuel sulphur content, while the systems for exhaust gas treatment and diagnostic engine combustion systems, whose efficiency is adversely impacted by sulphur, additionaly reduce the volume of harmful substances.
In agricultural machinery, environmental pollution control mostly proceeds through reduced fuel sulphur content.
Directive 2003/17/EC, improvement of Directive 98/70/EC relating to the quality of petrol and diesel fuels brings ammendments, taking into account a number of previously established commitments, listing also the ones of importance for agricultural machinery. Directives are indicated referring to the emission of gases and particulates from agricultural and forestry tractors and off-road vehicles, as well as fuel quality, in order to ensure monitoring within the national system.

Thus ammendment 4(b) instructs EU members, among other things, to ensure certain volumes of diesel fuel on their territory for off-road vehicles, agricultural and forestry tractors, with sulphur content below 2,000 mg/kg. As of 01/01/2008, diesel fuel for such machinery may contain up to 1,000 mg/kg sulphur, or even less, or again same as diesel fuel (Table 5).

The entire tractor pool in Croatia includes around 20 % of those which must use diesel fuel with reduced sulphur content, which, on our market, is called *Eurodizel* (Fig. 1).

Conclusions

1. In Croatia, there is not enough attention paid to fuels for agricultural machinery, forestry tractors and off-road vehicles, in all the segments:
   - legislative regulations,
   - qualified translation of guidelines for using specific types of fuel,
   - user training,
   - fuel quality,
   - quality control.
2. The Croatian market has ensured the necessary fuel quality with less than 500 mg/kg of sulphur, while the state needs to regulate its privileged use, in the amount of around 20 % of the overall needs for agricultural tractors.
3. The Croatian market must ensure low sulphur diesel fuel for agricultural machinery below 2,000 mg/kg, and – as of 01/01/2008, with maximum share of 1,000 mg/kg of sulphur.

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1. Uredba o kakvoći tekućih naftnih goriva, NN 53:2006
2. Uredba o biogorivima, NN 141:2005
3. HRN EN 590: 2004, Dizelsko gorivo
4. Directive 2003/17/EC of the European Parlament and of the Council of 3 March 2003, amending Directive 98/70/EC relating of petrol and diesel fuels
5. ASTM D 975-96a:1996

UDK	ključne riječi	key words
621.431.7 : 631.7	motori poljoprivrednih strojeva	engines for agricultural machines
665.753.4.033.53	dizelsko gorivo, sadržaj sumpora	diesel fuel, sulfur content
351.777(4)	EU program za čišće motorno gorivo 2007-2009	EU programme for clean motor fuel 2007-2009

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