TWO DAYS TRAINING ON THE OPERATION AND MANAGEMENT OF WWTPS

9-10 September, Murcia

MANAGEMENT, LEGISLATION AND DISPOSAL OF SEWAGE SLUDGE: AGRICULTURAL APPLICATION

Presented by: Olga Herrero Chamorro

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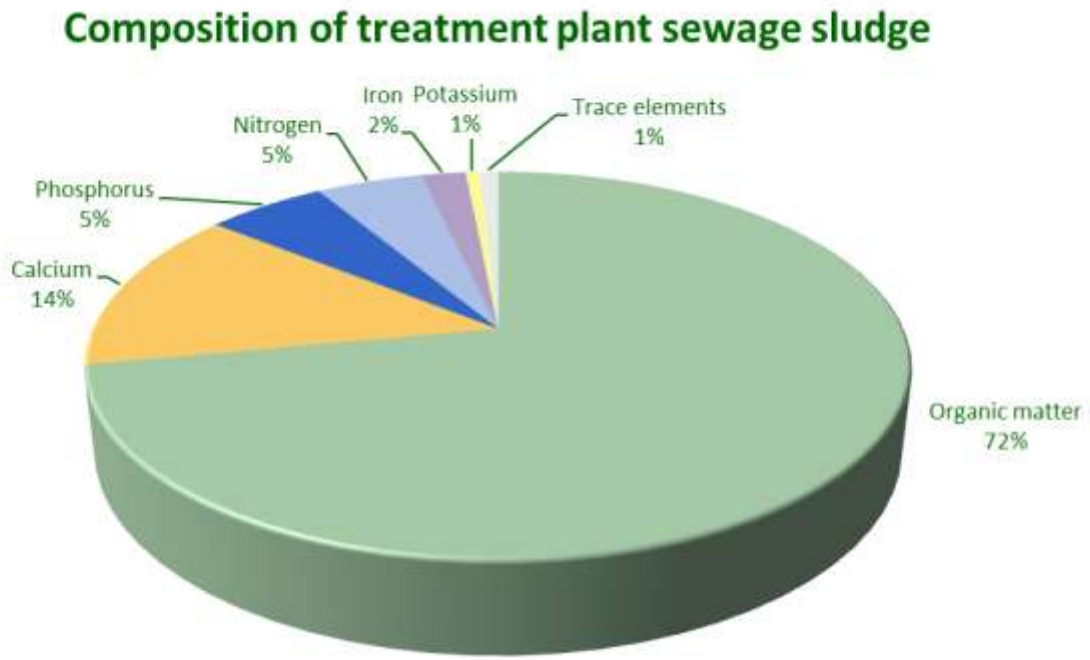
5. SEWAGE SLUDGE MANAGEMENT COSTS
6. CONCLUSIONS AND FINAL REMARKS

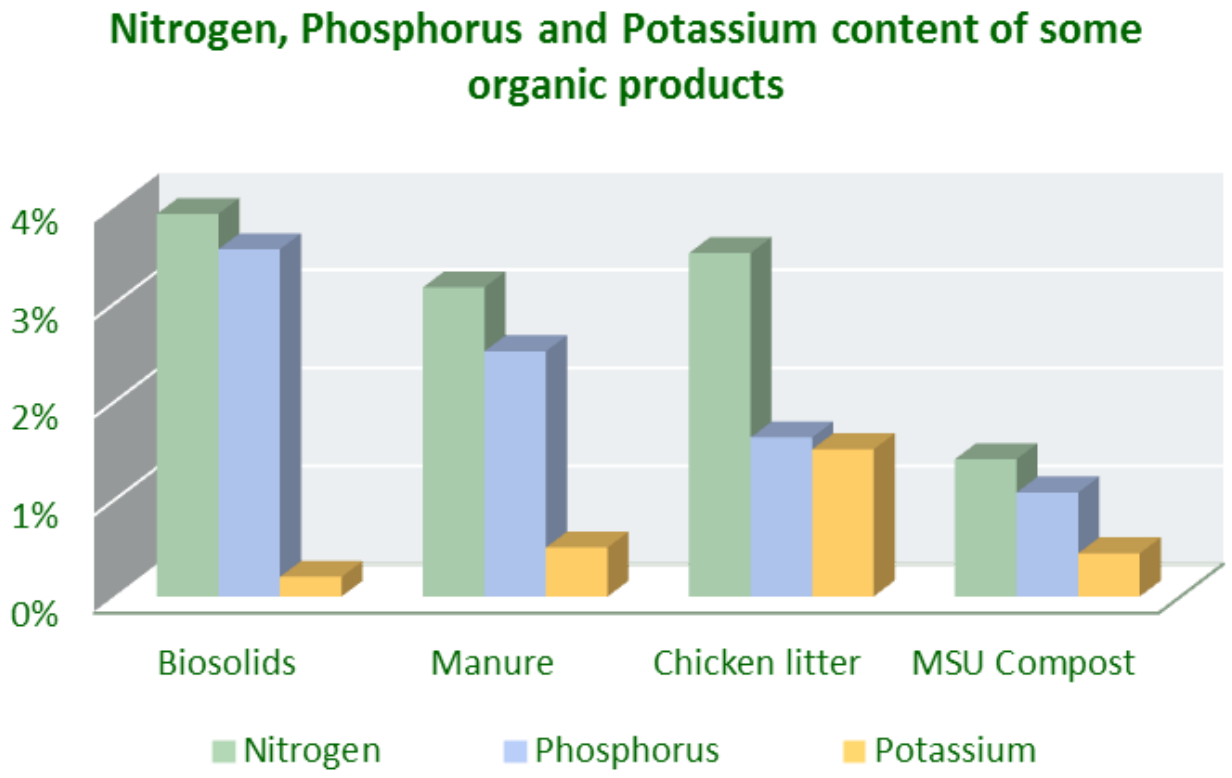
CHARACTERISTICS OF TREATMENT PLANT SEWAGE SLUDGE

- ✓ Semi-solid waste that has been separated from wastewater by way of various treatment processes
- ✓ Directly resulting from the treatment of wastewater in a wastewater treatment plant (WWTP)



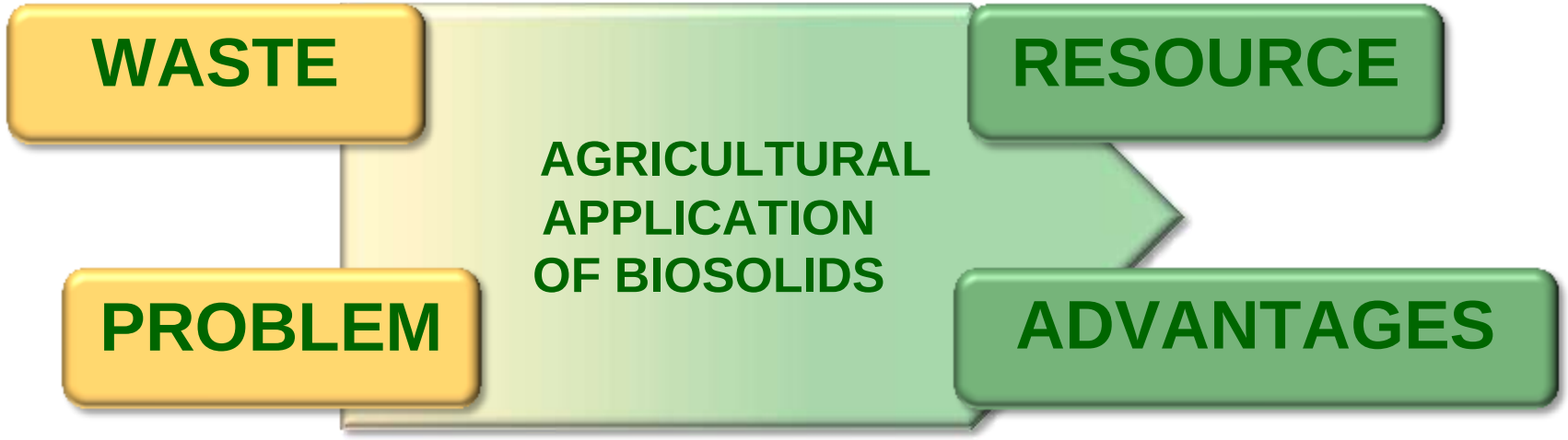
CHARACTERISTICS OF TREATMENT PLANT SEWAGE SLUDGE

- ✓ Composition of sewage sludge from treatment plants is no different from the rest of organic amendments used in agriculture



CARACTERISTICS OF TREATMENT PLANT SEWAGE SLUDGE

Agricultural recycling of biosolids makes it possible for waste to be turned into a resource



1. CHARACTERISTICS OF TREATMENT PLANT SEWAGE SLUDGE
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PRODUCTION AND DISPOSAL OF TREATMENT PLANT SEWAGE SLUDGE

Production of biosolids in Europe

Country	Production Biosolids t DM year
Austria	266,100
Belgium	102,566
Denmark	140,021
Finland	147,000
France	910,255
Germany	2,059,351
Greece	125,977
Ireland	42,147
Italy	1,070,080
Luxembourg	7,750
Netherland	550,000
Spain	759,915
Sweeden	210,000
United Kingdom	1,544,919
Bulgaria	29,987
Czech Republic	220,700
Hungary	128,380
Poland	523,674
Romania	137,145
Slovenia	19,434
Slovakia	54,780
TOTAL tDM/ Year	**9,050,181**

Production of biosolids in Europe:

9,050,181 t DM / year

36,200,724 t WM / year

Source: WRC and RPA for the European Commission 2010

Production of biosolids in Spain

Autonomous Community	Production Biosolids t DM/year
Andalusia	113,713
Aragón	28,527
Asturias	9,997
Balearic Islands	20,333
Canary Islands	16,910
Cantabria	21,021
Castile and León	22,045
Castile-La Mancha	56,000
Catalonia	136,738
Valencian Autonomous Community	99,839
Extremadura	36,000
Galicia	18,195
Madrid Autonomous Community	105,250
Murcia	25,450
Navarre	7,300
Basque Country	37,347
La Rioja	5,250
TOTAL t DM/ year	**759,915**

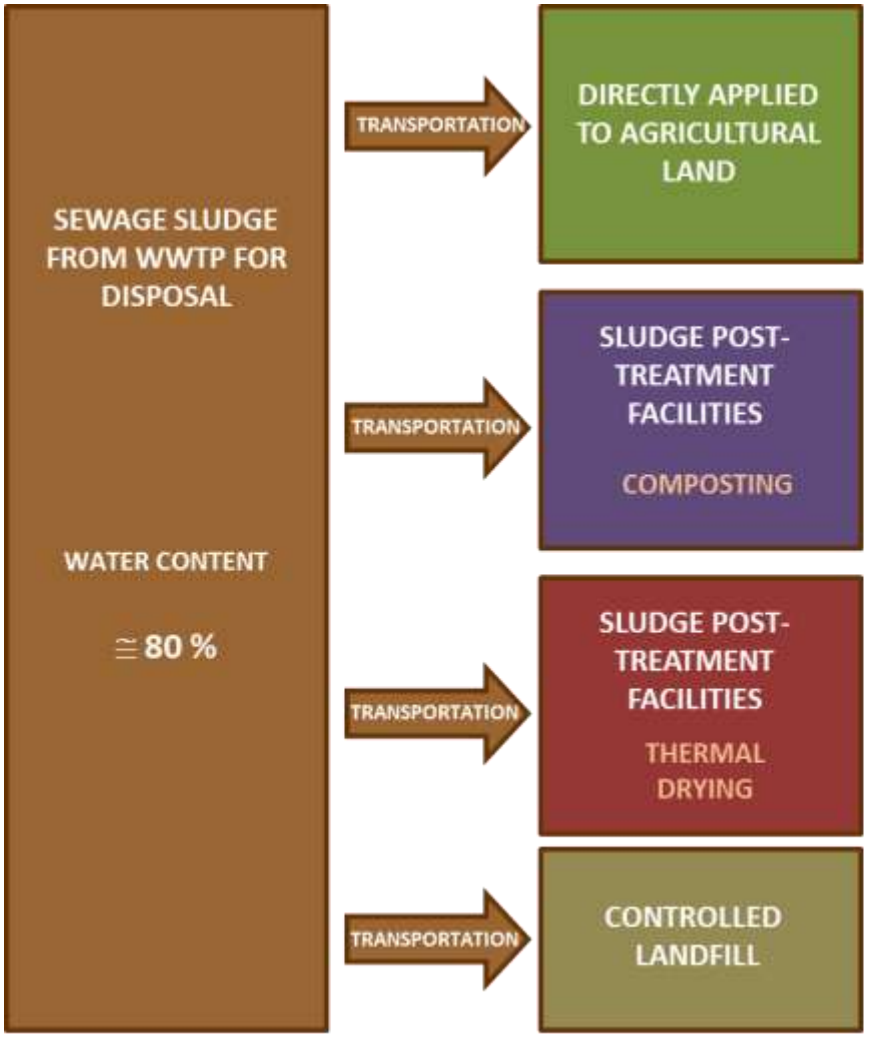
Production of biosolids in Spain:
759,915 t DM / year
3,039,660 t WM / year

anish Association of Water Supply and
AS) 20

These figures reflect the magnitude of the disposal problem

PRODUCTION AND DISPOSAL OF TREATMENT PLANT SEWAGE SLUDGE

Main alternatives in biosolids management



ADVANTAGES:
- LOWER COST
- NUTRIENTS ADDED TO SOIL

DISADVANTAGES:
- CONDITIONED BY WEATHER
- POSSIBLE ODOR EMISSIONS

ADVANTAGES:
- SLUDGE IS STABILIZED
- REDUCED LEVEL OF PATHOGENIC ORGANISMS

DISADVANTAGES:
- HIGHER TREATMENT COST
- REQUIRES ADDITION OF BROWN MATERIALS

ADVANTAGES:
- REDUCED WATER CONTENT IN SLUDGE
- CAN USE FOR ENERGY GENERATION

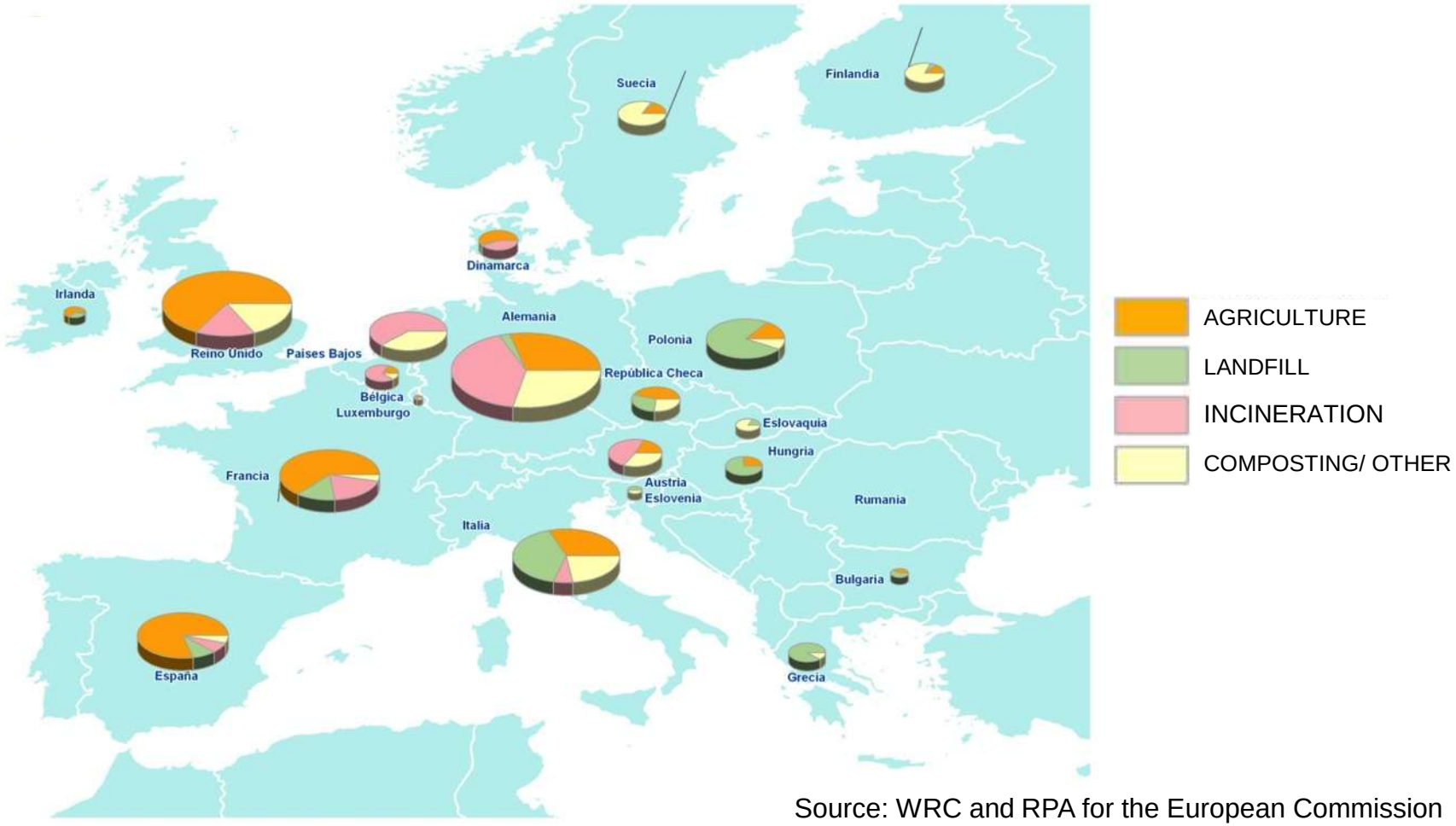
DISADVANTAGES:
- HIGH TREATMENT COST (GREATER THAN COMPOSTING)
- REQUIRES PROGRAMMED MAINTENANCE SHUTDOWNS

ADVANTAGES:
- GOOD OPTION WHEN NO OTHER OPTION IS FEASIBLE

DISADVANTAGES:
- SLUDGE CANNOT BE ASSESSED FOR OTHER USE
- HIGH MANAGEMENT COST

PRODUCTION AND DISPOSAL OF TREATMENT PLANT SEWAGE SLUDGE

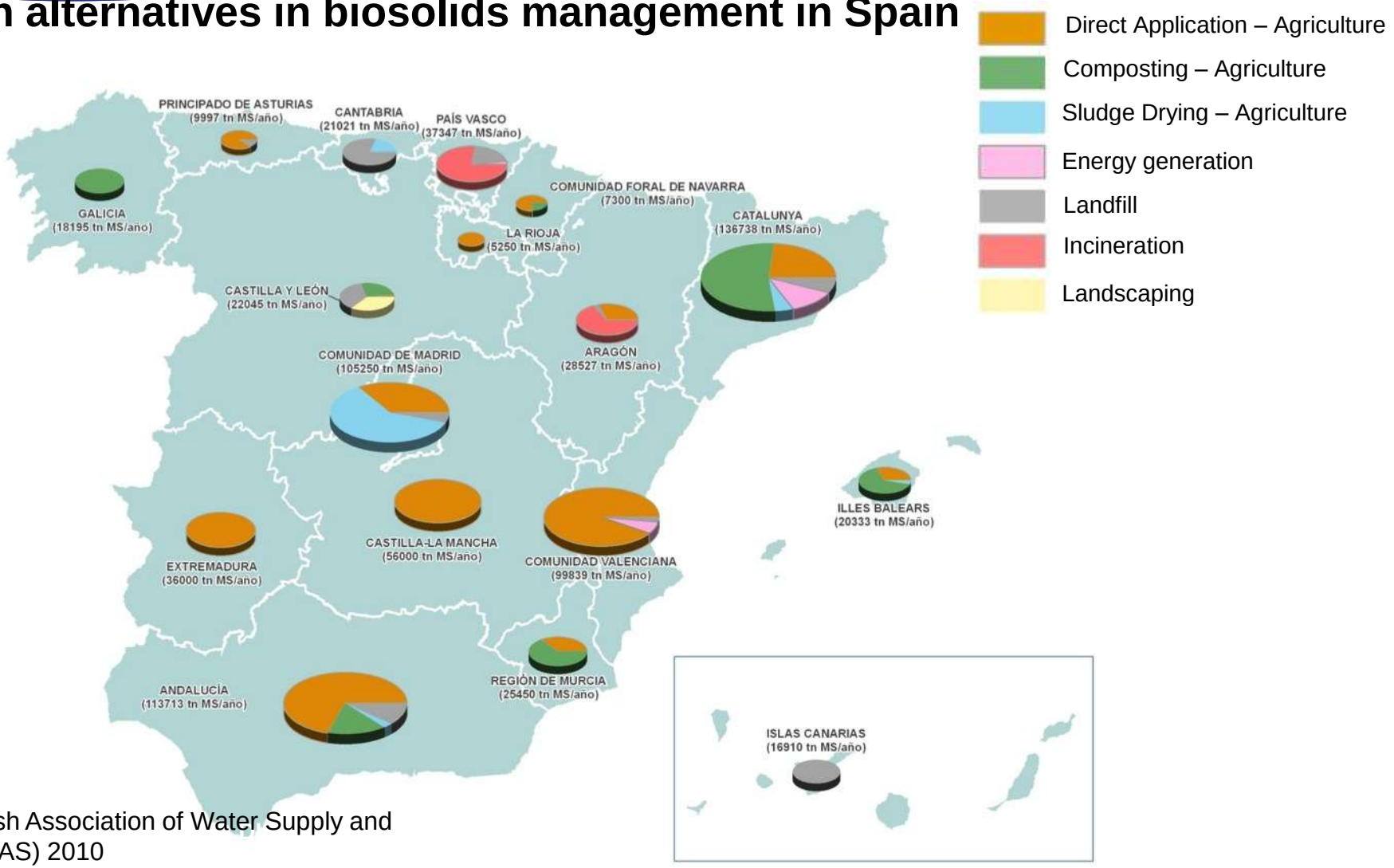
Main alternatives in biosolids management in Europe



Source: WRC and RPA for the European Commission 2010

PRODUCTION AND DISPOSAL OF TREATMENT PLANT SEWAGE SLUDGE

Main alternatives in biosolids management in Spain



Source: Spanish Association of Water Supply and Treatment (AEAS) 2010

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LEGISLATION APPLICABLE TO TREATMENT PLANT SEWAGE SLUDGE

European Legislation

Use of Biosolids in agriculture

- ✓ **Council Directive 86/278/EEC of** 12 June 1986, on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.
- ✓ **4th Draft of Directive on the use of sewage sludge in agriculture**
- ✓ **Council Directive 91/676/EEC of** 12 December, concerning the protection of waters against pollution caused by nitrates from agricultural sources.
- ✓ **Regulation (EC) No. 2003/2003 of the** European Parliament and of the Council of 13 October 2003 concerning fertilizers.

Waste Management

- ✓ **Council Directive 2008/98/EC of the** European Parliament and of the Council of 19 November 2008
- ✓ **Council Directive 1999/31/EC** of 26 April 1999, on the landfill of waste
- ✓ **COUNCIL DECISION of 19 December 2002** establishing criteria and procedures for the acceptance of waste at landfills
- ✓ **Directive 2000/76/EC** of the European Parliament and of the Council of 4 December 2000 on the incineration of waste

LEGISLATION APPLICABLE TO TREATMENT PLANT SEWAGE SLUDGE

CURRENT GUIDELINES	DIRECTIVE 86/278/CEE
DRAWBACKS	Does not take agronomic aspects into account
	Only regulates heavy metal content and its contribution to soils
	Does not include other uses for soil

PROPOSED REGULATIONS	4TH DRAFT OF DIRECTIVE ON THE USE OF SEWAGE SLUDGE IN AGRICULTURE
MAIN ASPECTS	Distinguishes between advanced and conventional sewage sludge treatments, in accordance with end use
	Two types of soil use are defined (agricultural and non-agricultural)
	Reduction in maximum permitted concentrations of heavy metals in sewage sludge and soil
	Limit values are introduced for persistent pollutants, toxic compounds, organic bioaccumulative substances and certain surfactants
	Pathogenic bacteria content is limited (Escherichia coli, Salmonella spp. and Clostridium perfringens)
	Establishes frequencies and methods for sampling and analysis of soils and sewage sludge

LEGISLATION APPLICABLE TO TREATMENT PLANT SEWAGE SLUDGE

Spanish Legislation:

Use of biosolids in agriculture

- ✓ **Royal Decree 1310/1990** of 29 October, which regulates the use of sewage sludge from sewage treatment plants in the agricultural sector.
- ✓ **Order AAA/1072/2013** of 7 June, concerning the use of sewage sludge from sewage treatment plants in the agricultural sector.
- ✓ **2nd National Plan on Sewage Sludge from Wastewater Treatment Plants (2007-2015).**
- ✓ **Royal Decree 261/1996** of 16 February, concerning the protection of waters from pollution caused by nitrates from agricultural sources.

Waste Management

- ✓ **Law 22/2011** of July 28, on waste and contaminated soil.
- ✓ **Royal Decree 1481/2001** of 27 December, which regulates the disposal of sewage sewage sludge in landfill sites.
- ✓ **Royal Decree 653/2003** of 30 May, on the incineration of waste

LEGISLATION APPLICABLE TO TREATMENT PLANT SEWAGE SLUDGE

RD 1310/90 establishes:

Upper limit soil metal concentration (mg/kg DM)

PARAMETERS	Soils with pH less than 7	Soils with pH greater than 7
Cadmium	1	3
Copper	50	210
Nickel	30	112
Lead	50	300
Zinc	150	450
Mercury	1	1.5
Chromium	100	150

Upper limit sewage sludge metal concentration (mg/kg DM)

PARAMETERS	Soils with pH less than 7	Soils with pH greater than 7
Cadmium	20	40
Copper	1,000	1,750
Nickel	300	400
Lead	750	1,200
Zinc	2,500	4,000
Mercury	16	25
Chromium	1,000	1,500

Upper limit: quantity of metal that can be introduced in the soil (kg/ha/year)

PARAMETERS	LIMIT VALUES
Cadmium	0.15
Copper	12.00
Nickel	3.0
Lead	15.00
Zinc	30.00
Mercury	0.10
Chromium	3.00

LEGISLATION APPLICABLE TO TREATMENT PLANT SEWAGE SLUDGE

New Order AAA/1072/2013 of 7 June, on the use of sewage sludge from treatment plants in the agricultural sector	
 **MAIN ASPECTS**	An attempt is made to improve information on treatment, production and tracking of sewage sludge
	The types of sewage sludge that can be directly applied to agricultural soil are specifically defined
	Further delimits the concept of treated sewage sludge
	Microbiological parameters are included for sewage sludge
	It is mandatory to notify where sewage sludge is applied in the Autonomous Community

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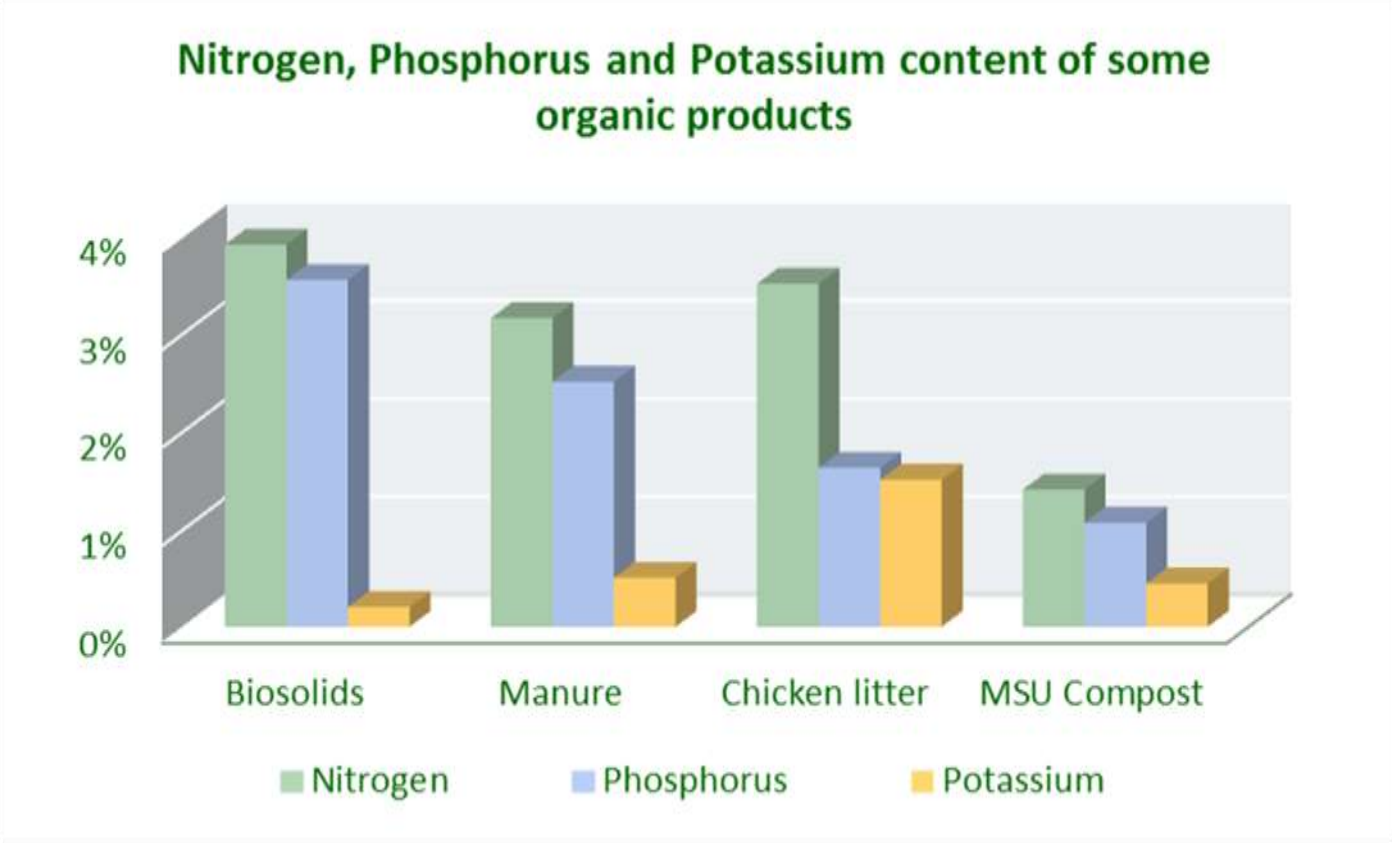
AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

- ✓ Composition of sewage sludge from treatment plants is no different from the rest of organic amendments used in agriculture



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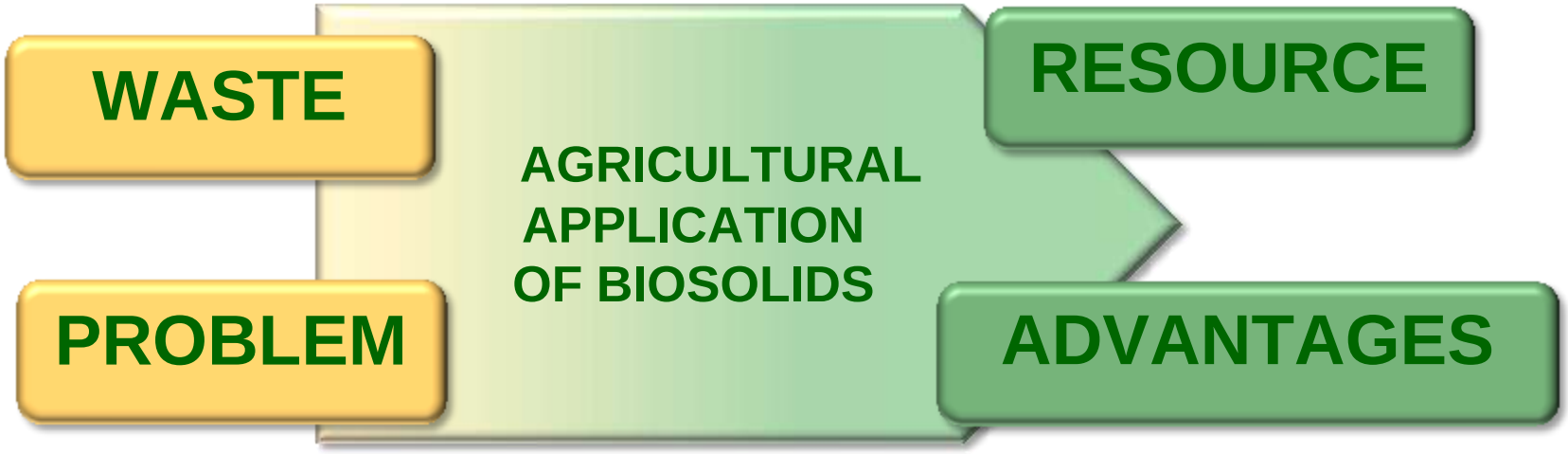


Sludge. Yes, it IS a resource... but our farmers are still doubtful...

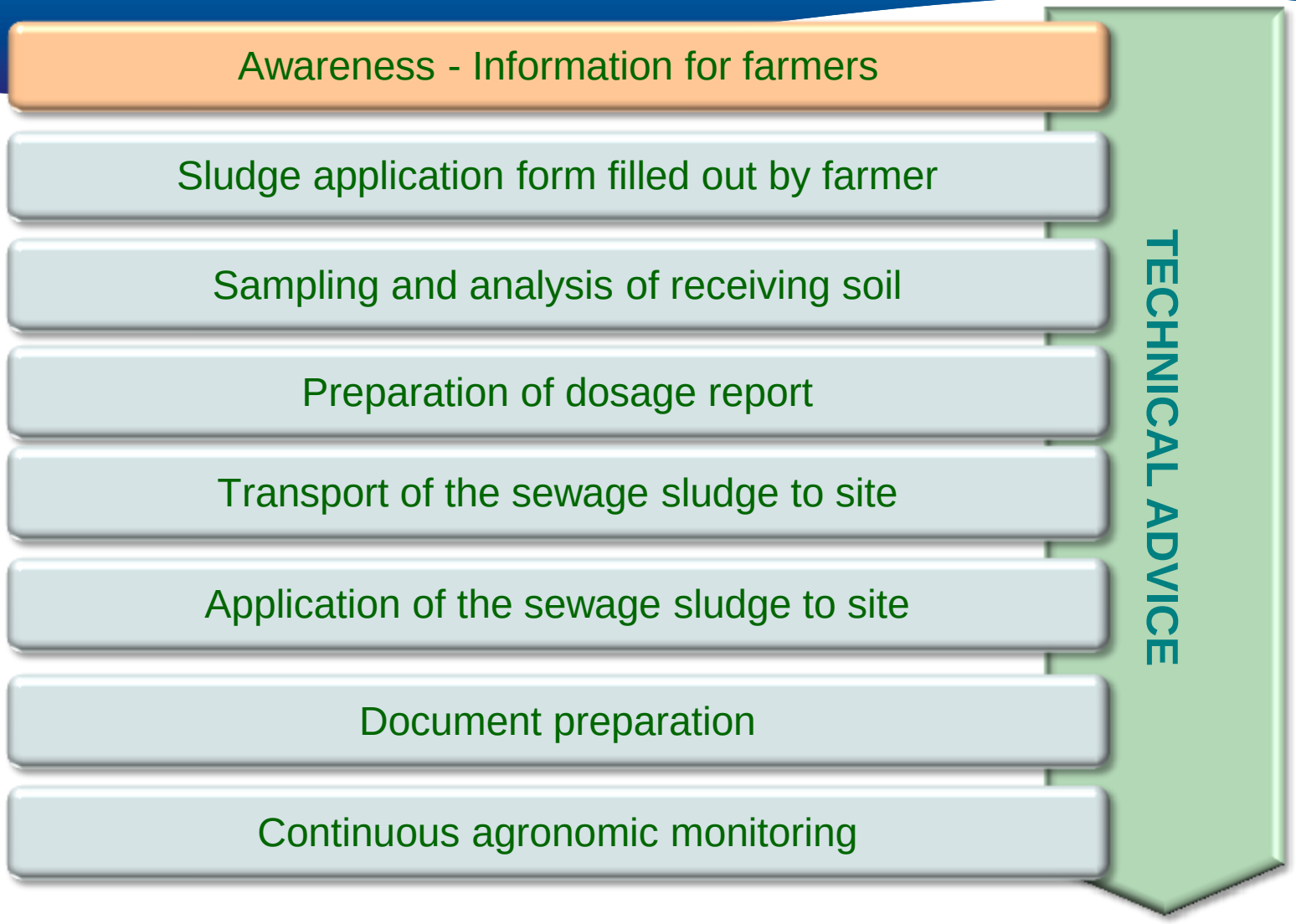
- It comes from the city... what's in it?
- It probably contains a lot of strange things
- If they're giving it away, then it's probably not good...
- How do I apply it and at what dosage…?

... and lastly...

- I'm going to wait until my neighbor uses it first and then I'll see...

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

METHODOLOGY



AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

Factors to be considered for proper agricultural sewage sludge management

METHODOLOGY

- Sludge must comply with the provisions of the regulations in force
- Counseling, education and personalized advice to farmers
- Transport and application should be carried out with specific equipment
- Avoid sewage sludge stockpiling in locations that may pose an environmental risk
- Integration of nutrient input from sewage sludge with the farmers' crop fertilization program
- Ensure appropriate distribution of the recommended doses
- The following objectives must be met: Ensure profitability for the farmer, maintain soil fertility and minimize environmental impact

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

DOCUMENTATION

SOIL ANALYSIS

ENAC

LABORATORIOS TECNOLÓGICOS de LEVANTE

INFORME DE ENSAYO

Nº de Registro 13SL00478

Pedido nº

Datos de la muestra

Fecha Toma de Muestra: 09/07/2013
Fecha Recepción: 12/07/2013
Tipo de muestra: Suelo. Muestra simple.
Toma de muestra: Cliente
Identificación:

Fecha Inicio: 12/07/2013
Fecha Fin: 19/07/2013

Parámetro	Resultado	Valor de ref.	Ud.	Incert. (k=2)	Método
Cadmio total	<1.5		mg/kg ms		PrLTL-6.095 (ICP)
Cromo total	30.3		mg/kg ms		PrLTL-6.095 (ICP)
Cobre total	34.6		mg/kg ms		PrLTL-6.095 (ICP)
Mercurio total	<0.13		mg/kg ms		PrLTL-6.089 (Aquarius, FLD)
Potasio asimilable (K)	841		mg/kg ms		PrLTL-6.084 (Ext., ICP)
Níquel total	16.5		mg/kg ms		PrLTL-6.095 (ICP)
Fósforo soluble (P)	100		mg/kg ms		PrLTL-6.160 (Ext. NaHCO3, abs. molecular)
Plomo total	11.0		mg/kg ms		PrLTL-6.095 (ICP)
Zinc total	85.9		mg/kg ms		PrLTL-6.095 (ICP)

Observaciones:

Los ensayos marcados en este informe (*) no están incluidos en el alcance de la acreditación del laboratorio.
Este informe afecta sólo a la muestra sometida a ensayo. El informe no debe reproducirse parcialmente sin la aprobación por escrito de Laboratorios Tecnológicos de Levante, SL.
Los incertidumbres de las medidas están calculadas y a disposición del cliente.
En el caso de muestras tomadas por el cliente, los siguientes datos han sido suministrados por el cliente: fecha y hora de toma de muestra, tipo de muestra, identificación.

Paterna, a 19/07/2013

Fdo.: Eduardo Gimeno
Director Técnico Laboratorio

C/Benjamín Franklin, 16 (Parque Tecnológico)- 46980 Paterna (VALENCIA) - TELS.: 96 366 12 16-96 366 12 50 - Fax: 96 371 13 58 -E-mail: aguas@tlevante.com
CIF: B-97.732.754 - Reg. mercantil de Valencia, tomo 8435, Libro 5725, Folio 80, hoja V-113324.

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

DOCUMENTATION

SEWAGE SLUDGE ANALYSIS

ivia
instituto valenciano
de investigaciones agrarias

Ref. Laboratorio : L / 3806

Identificación: DAM
EDAR Villajoyosa
Fango deshidratado

Fecha de muestreo: 03/04/2013
Fecha recepción de la muestra: 04/04/2013

Boletín de Análisis

PARÁMETROS	MÉTODO	UNIDADES	RESULTADO
Humedad muestra a 105ºC	105ºC. s.p.t.	% s.p.t.	83,3
Materia orgánica total	Calcinación	% s.m.s.	82,1
Materia orgánica oxidable	Oxidación	% s.m.s.	79,8
Carbono orgánico oxidable	Oxidación	% s.m.s.	46,3
pH (sol. acuosa 1 : 25)	Electrometría	Unidades de pH	6,11
Nitrógeno total	N - Kjeldhal	% s.m.s.	7,32
Relación C / N	Cálculo	.....	6,32
Fósforo (P_2O_5)	ICP - Plasma	% s.m.s.	3,41
Potasio (K_2O)	ICP - Plasma	% s.m.s.	0,49
Calcio (CaO)	ICP - Plasma	% s.m.s.	3,97
Magnesio (MgO)	ICP - Plasma	% s.m.s.	0,63
Sodio (Na_2O)	ICP - Plasma	% s.m.s.	0,21
Boro (B)	ICP - Plasma	ppm s.m.s.	10,3
Hierro (Fe)	ICP - Plasma	ppm s.m.s.	2396
Cobre (Cu)	ICP - Plasma	ppm s.m.s.	211
Manganeso (Mn)	ICP - Plasma	ppm s.m.s.	49,9
Cinc (Zn)	ICP - Plasma	ppm s.m.s.	393
Níquel (Ni)	ICP - Plasma	ppm s.m.s.	23,0
Plomo (Pb)	ICP - Plasma	ppm s.m.s.	29,6
Cadmio (Cd)	ICP - Plasma	ppm s.m.s.	0,64
Cromo (Cr)	ICP - Plasma	ppm s.m.s.	23,6
Mercurio (Hg)	EAA/001-a	ppm s.m.s.	< 0,80
Conductividad eléctrica (extracto. 1:5)	Electrometría	dS/m a 25º C	10,8

* Este fango es adecuado para su utilización en agricultura según la normativa vigente (Real Decreto 1310/1990)

Vº. Bº. : Fernando Pomares Garcia

Vº. Bº. : Francisco Tarazona Pascual

Moncada, 3 de mayo de 2013

Los resultados analíticos solamente se refieren a la muestra analizada

Crra Moncada - Naquera km 4,5; 46113 Moncada (Valencia) Telefono: 963424000 Fax: 963424001

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

DOCUMENTATION

SEWAGE SLUDGE APPLICATION FORM

Solicitud de aplicación de fangos

D. ..... DNI .....
domicilio.....Municipio:.....
teléfono ..... Como propietario de la finca o terreno con los siguientes datos parcelarios y agronómicos:

Provincia:..... .....Municipio:..... ....
Polígono:.....

Parcelas.....

Cultivo:..... Ciclo de Cultivo:..... ...
Tipo de Riego:.....Producción Esperada:..... .....

SOLICITA
Que se le cedan anualmente las cantidades oportunas de fango tratado de las EDARs de la UTE S y D Aguas para su aplicación en uso agrícola en los terrenos de su propiedad, y que suman una superficie total de..... hectáreas.

AUTORIZA
Al personal de la empresa UTE S y D Aguas a acceder a las propiedades, para proceder a la toma de muestra de suelo y agua que permitan verificar la correcta aplicación de los fangos al terreno y la ausencia de afecciones ambientales indeseables, de cuyos resultados dará información a este propietario cuando así lo solicite.

Y DECLARA
Que todos los datos contenidos en la presente solicitud relativos a la titularidad y descripción de la finca o terreno son ciertos.

En ..... a ..... de ..... de 2013.

Fdo: .....

- Los fangos solicitados serán gratuitos para los agricultores.
- Los técnicos responsables de UTE S y D Aguas, realizarán un seguimiento de todas las parcelas a las que se apliquen fangos, asesorando gratuitamente a los agricultores.

Los datos personales contenidos en el presente formulario y cualquier Anexo al mismo, así como cualquier otro dato que pudiera facilitarse a lo largo de la relación, serán recogidos en un fichero titularidad S.A. AGRICULTORES DE LA VEGA DE VALENCIA y DEPURACIÓN DE AGUAS DEL MEDITERRÁNEO, S.L. Todos los datos son obligatorios y la negativa a suministrarlos implicará el que no podamos iniciar o mantener la relación por incumplir la normativa vigente. Este fichero tiene únicamente la finalidad de proceder a la cesión y entrega de los fangos recogidos por ambas empresas según la normativa vigente, teniendo como únicos destinatarios empleados vinculados a ellas y a las administraciones públicas competentes. El ejercicio de los derechos de acceso, rectificación, cancelación y oposición se podrá llevar a acabo en los términos legales mediante comunicación por carta a S.A. AGRICULTORES DE LA VEGA DE VALENCIA a la dirección:
Plaza Tetuan, 1 - 46003 Valencia
Departamento jurídico
Ref.: Datos personales
La firma del presente documento supone el otorgamiento de consentimiento expreso para que los datos contenidos en el mismo puedan ser recabados y tratados por S.A. AGRICULTORES DE LA VEGA DE VALENCIA y, en su caso, cedidos a aquellas entidades con las que la Compañía constituya UTEs o suscriba acuerdos para la ejecución de los contratos administrativos en que sea parte. Estos datos serán almacenados y tratados por dicha/s empresa/s en los términos aquí establecidos y exclusivamente con la finalidad antedicha.

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

DOCUMENTATION

DATOS IDENTIFICATIVOS SIGPAC

Provincia: 46 - VALENCIA
Municipio: 261 - VILLARGORDO DEL CABRIEL
Agregado: 0 Zona: 0
Polígono: 9 Parcela: 440

Coordenadas UTM del centro	Fecha de vuelo de la foto del centroide de la parcela: 10/2008
	Año de renovación Catastral: 2003
X: 637656,18 Y: 4377287,55 HUSO: 30	Fecha de impresión: 14/04/2010
	Escala aproximada de impresión: 1: 4500

DATOS IDENTIFICATIVOS SIGPAC

Provincia: 46 - VALENCIA
Municipio: 261 - VILLARGORDO DEL CABRIEL
Agregado: 0 Zona: 0
Polígono: 9 Parcela: 440

Información SIGPAC asociada

A) Relativos al recinto:

Recinto	Superficie (ha)	Pendiente (%)	Elegible (%) *	Uso	Coef. Regadío	Incidencias (1)
1	2,0494	6,3	0	FRUTOS SECOS	0	
2	0,0511	7,7	100	VIÑEDO	0	
3	1,9131	7,3	0	PASTO ARBUSTIVO		
4	0,7679	5,3	100	TIERRAS ARABLES	0	11
5	0,1458	2,4	0	FRUTOS SECOS	0	
6	0,4643	3,3	0	PASTIZAL		7,18
7	2,4888	3,0	100	TIERRAS ARABLES	0	14
8	1,6028	4,6	0	TIERRAS ARABLES	0	14
9	0,2587	3,7	0	FRUTOS SECOS	0	
10	0,8355	5,5	0	VIÑEDO	0	
11	0,0400	7,0	0	PASTO ARBUSTIVO		
12	0,0884	6,8	0	VIÑEDO	0	7

* - Sólo a efectos de Cultivos Herbáceos.

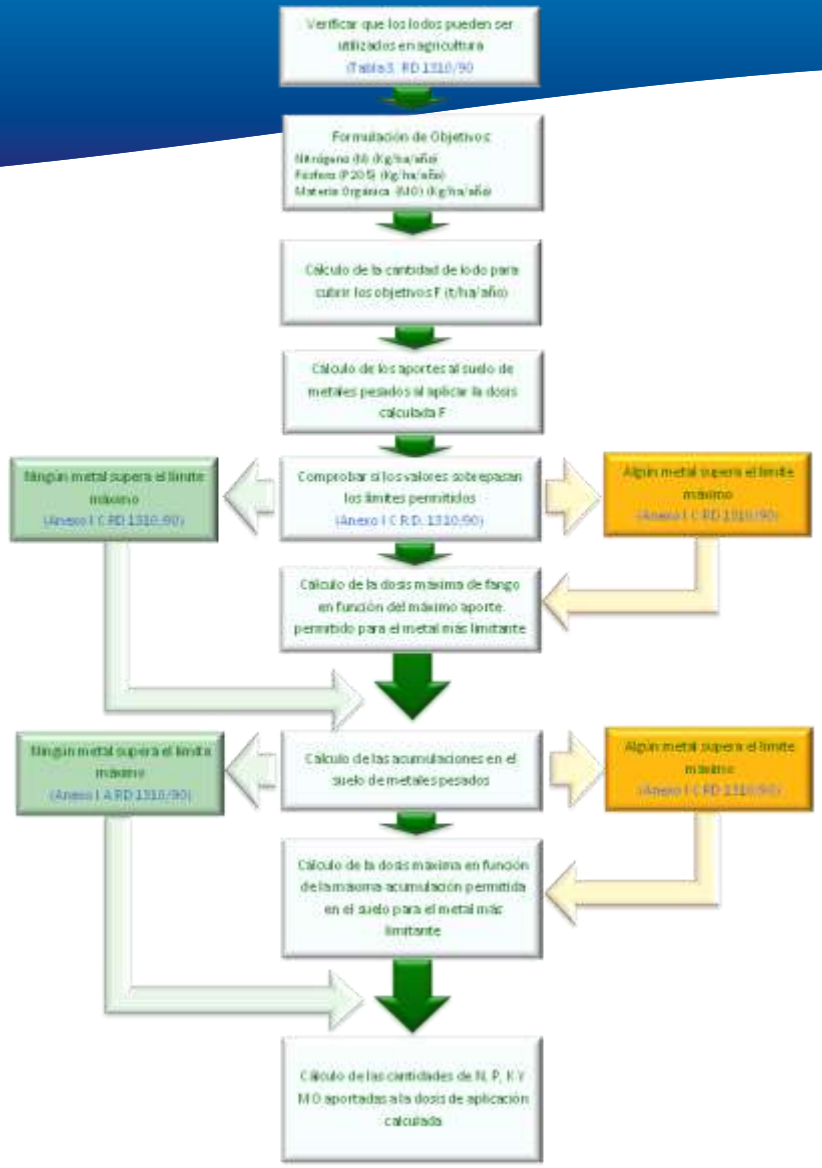
(1) La descripción de las incidencias SIGPAC aparece en el menú de Ayuda del Visor SIGPAC

SITE INFORMATION

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

DOCUMENTATION

DOSE CALCULATION



AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

DOCUMENTATION

SEWAGE SLUDGE DOSE REPORT

IVIA

INFORME DE DOSIFICACIÓN DE LODOS DE EDAR

Informe	Fecha	Código identificación suelo:
GV22	23/01/2010	538,2010

Destinatario

Nombre	Jose Guata Suarez		
Dirección	C/ Carretera nº 42	**Teléfono**	625333329
Municipio	Villargordo del Cabriel	**Provincia**	Valencia

Parcela

Paraje		**Polígono**	9
Municipio	Villargordo del Cabriel	**Parcela**	440,457,456,454
Provincia	Valencia	**Superficie (ha)**	11,6

Cultivo

Cultivo actual	Cereal	**Producción prevista**	
Ciclo del cultivo		**Tipo de riego**	Secano

Evaluación agronómica del suelo

Suelo apto para recibir lodos, según R.D. 1310/90, sobre aplicación de lodos en agricultura

Parámetro	Nivel
Materia orgánica (%)	Normal
Fósforo (P)(ppm)	Alto
Potasio (K)(ppm)	Alto

Dosificación lodo

EDAR	% MS	Dosis t/ha (MS)	Dosis t/ha (MH)	Dosis t/ha (MH) R.D. 1310/1990*	Cantidad total t (MS)	Cantidad total t (MH)
G. VALENCIA	20,7	7,8	37,9	174,06	90,5	440

Aporte en materia orgánica y nutrientes

	Necesidades (Kg/ha)	Aportados (kg/ha)	Reducción abonado mineral 1º año(kg/ha)	Reducción abonado mineral 2º año(kg/ha)	Reducción abonado mineral 3º año(kg/ha)
Materia orgánica		5.155			
Nitrógeno (N)	100	400	100	50	24
Fósforo (P2O5)	60	345	345		
Potasio (K2O)	60	29	29		

Recomendaciones para su aplicación y manejo

Esta cantidad de biosólido debe aplicarse incorporado de forma homogénea por toda la superficie de la parcela, con una antelación de 1 o 2 meses a la siembra.

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* Dosis (t/ha) máxima a aplicar anualmente de acuerdo con el contenido en metales pesados según R.D. 1310/1990.
Al grupo Valencia pertenecen las EDARs de Algemesí, Alzira, Carraixet, Camp de Turia II, Cullera, Pobla de Farnals, Javea, Sagunto
Este informe de dosificación ha sido realizado con las analíticas de lodo 3146,3022,3050,3094,3026,2985,2978,3158.
NOTA: A este informe se adjunta la analítica de suelo y lodos correspondientes.

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

DOCUMENTATION

DOCUMENTO DE IDENTIFICACIÓN DE LOS LODOS

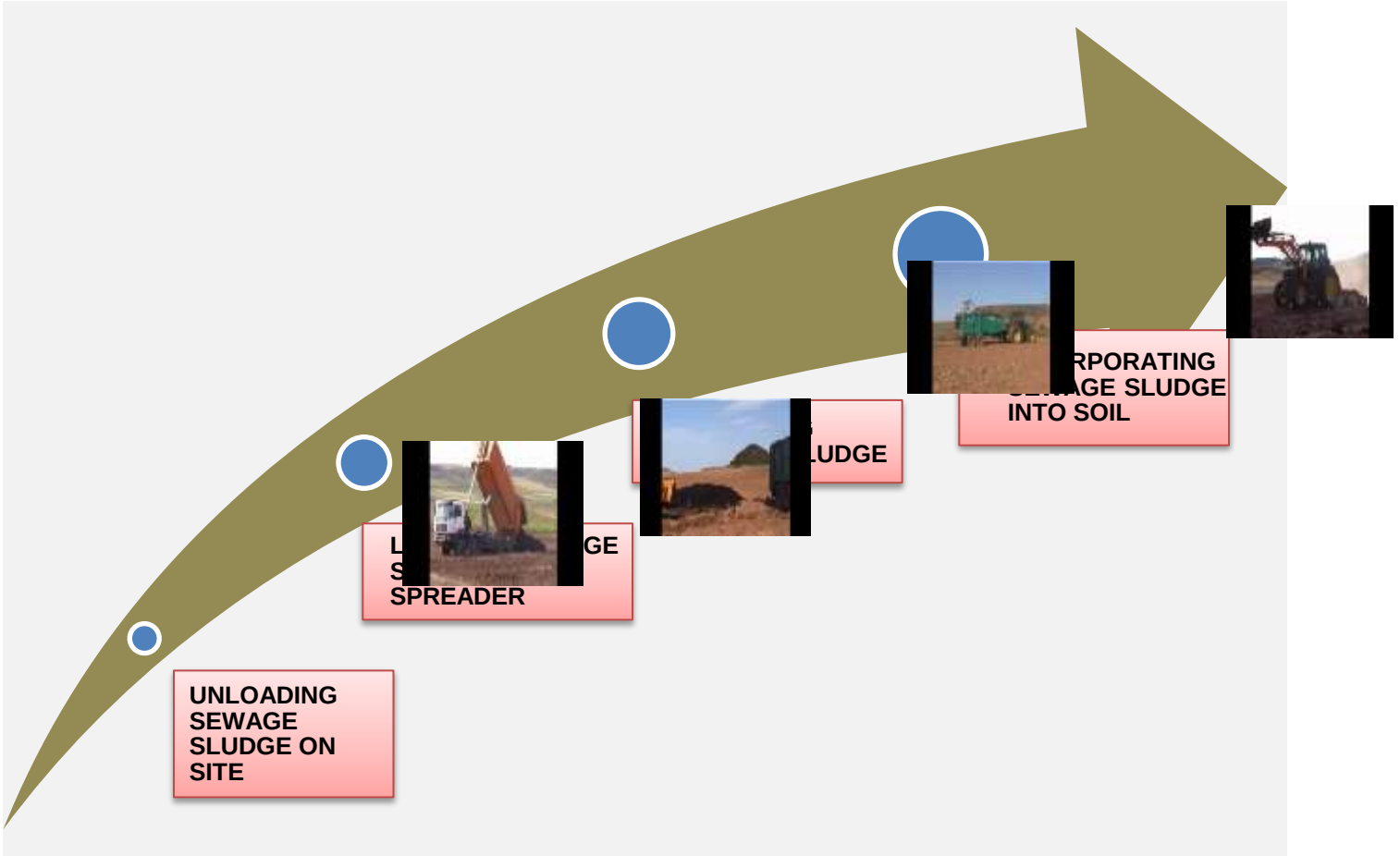
INFORMACIÓN DE LA INSTALACIÓN DE TRATAMIENTO DE LOS LODOS					
Nombre de la **instalación**:				NIMA:	
Entidad concesionaria de la instalación:				NIF:	
INFORMACIÓN DE LOS LODOS TRANSPORTADOS					
Tratamientos aplicados a los lodos (tanto en la EDAR como en otras instalaciones)	Digestión anaerobia ☐ Tratamiento quimico ☐ Compostaje ☐ Otros Tratamiento: ☐ (Especificar:)				
Cantidad Transportada (t):		**Materia seca** (%):		**Cantidad transportada** (t.m.s.):	
Ref. Análisis de lodo:					
Metales Pesados	**Valor**	**Unidades**	**Parámetros agronómicos**	**Valor**	**Unidades**
Cadmio		mg/kg m.s.	Materia seca		%
Cobre		mg/kg m.s.	Materia orgánica total		% (sobre m.s.)
Niquel		mg/kg m.s.	ph		-
Plomo		mg/kg m.s.	C/N		-
Zinc		mg/kg m.s.	Nitrógeno total		% N (sobre m.s)
Mercurio		mg/kg m.s.	Nitrógeno Amoniacal		% NH_4^+ (sobre m.s.)
Cromo		mg/kg m.s.	Fósforo total		mg P_2O_5/kg m.s.
Parámetros microbiológicos	**Valor**	**Unidades**	Potasio total		mg K_2O/kg m.s.
			Calcio total		mg CaO/kg m.s.
Salmonella		Presencia o ausencia/25g	Magnesio total		mg MgO/kg m.s.
Escherichia coli		u.f.c./g	Hierro		mg FeO/kg m.s.
INFORMACIÓN DEL GESTOR QUE REALIZA LA APLICACIÓN DE LOS LODOS					
Nombre/Razón social de Gestor:				NIF:	
Municipio de aplicación:				Provincia:	
INFORMACIÓN DEL TRANSPORTISTA DE LODOS					
Nombre:				NIF:	
Matricula del vehiculo:					
INSTALACIÓN DE TRATAMIENTO DE LOS LODOS			**GESTOR QUE REALIZA LA APLICACIÓN DE LOS LODOS**		
Firma: Fdo: Fecha:			Firma: Fdo: Fecha:		

FO 8.1.2, r0, 09.07.2013

DOCUMENTATION SEWAGE SLUDGE CONTROL AND MONITORING

STAGES OF PROPER SEWAGE SLUDGE APPLICATION

SEWAGE SLUDGE APPLICATION

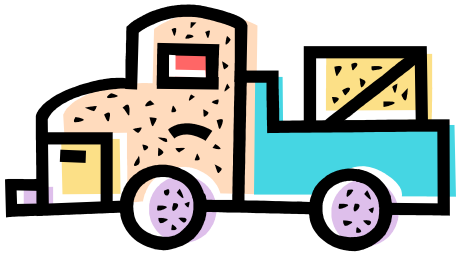


AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

AGRICULTURAL APPLICATION COSTS

- **TRANSPORT**
  - ❑ Storage Capacity of sewage sludge at WWTP
  - ❑ Type of transport
  - ❑ Distance to application site
  - ❑ Access to WWTP and application sites
  - ❑ Variations in fuel prices
- **SOIL ANALYSIS**
  - ❑ Applicable Legislation: RD 1310/90
- **SEWAGE SLUDGE ANALYSES**
  - ❑ Applicable Legislation: RD 1310/90
- **APPLICATION TO LAND**
  - ❑ Crop type
  - ❑ Use of machinery to apply sewage sludge
  - ❑ Access to machinery
  - ❑ Sludge moisture
- **PERSONNEL**
  - ❑ Qualified technical personnel:
    - ❑ Sludge management control
    - ❑ Locating sites and sampling work
    - ❑ Consultation for farmers
    - ❑ Dose calculation and crop monitoring
    - ❑ Agronomic monitoring of land
- **ADMINISTRATION AND MISCELLANEOUS**
  - ❑ Licenses, permits, insurance, communication and miscellaneous expenses

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE



TRANSPORT

STORAGE CAPACITY AT WWTP

> 25 tons

10

4-5

TRANSPORT

25 tons

10 tons

4-5 tons

TRANSPORT COST (for an average distance < 70 km)

€11 - 13 /ton

€28 - 33 /ton

€50 - 60 /ton

Improvements to direct application process developed by DAM

✓ Truck equipped with sewage sludge distribution system for transport and application

ADVANTAGES

- ✓ Direct and homogeneous distribution of sewage sludge on land
- ✓ Avoid stockpiling of sewage sludge on cropland and the drawbacks associated with this practice.
- ✓ Management costs are kept to a minimum because sewage sludge distribution is carried out in conjunction with transport.

Improvements to direct application process developed by DAM

ADVANTAGES

- ✓ GPS system for management and control of transport and application

- ✓ Location of vehicles in real time
- ✓ Routes taken by vehicles
- ✓ Date and time of the services provided (sewage sludge loading at WWTP and unloading at destination)
- ✓ Battery status of GPS device in real time
- ✓ Generate alerts to persons involved in sewage sludge monitoring to ensure adequate control of the process
  - ✓ Messages alerting to proximity or access to cropland or municipality.

Improvements to direct application process developed by DAM

✓ Geographic Information System (GIS) which manages and monitors information on agricultural sewage sludge application

ADVANTAGES

- ✓ Computer application that collects all information relating to the sewage sludge applied, its origin, characteristics, and dosage applied to each site.
- ✓ Allows for rigorous control of sewage sludge dosage, avoiding excessive or insufficient dosages for crops.
- ✓ **Ensures exhaustive control of agricultural sewage sludge application**

Examples of direct application of biosolids in agriculture

Crop: Peas

Examples of direct application of biosolids in agriculture

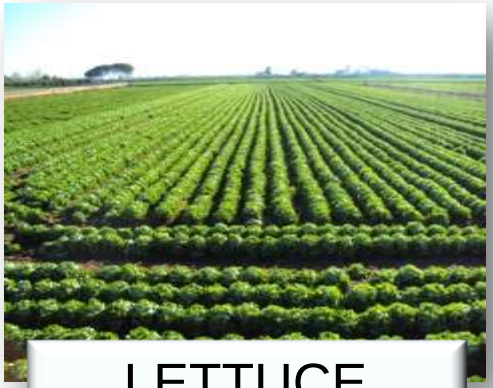
Crop: Barley

Inorganic fertilizer

Sludge

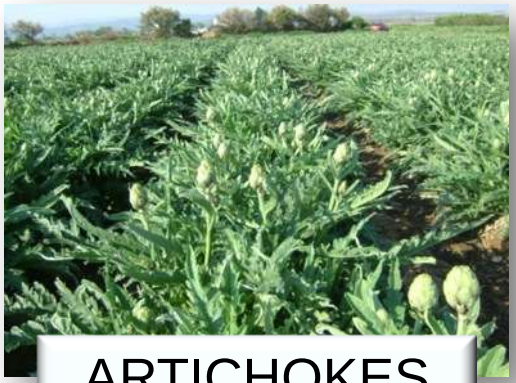
AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

Examples of direct application of biosolids in agriculture



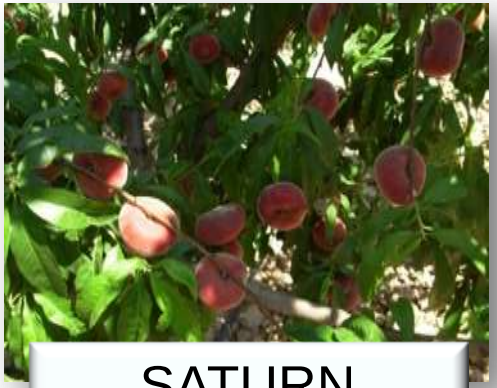
LETTUCE

CABBAGE



ARTICHOKES

TIGERNUT SEDGE



SATURN PEACHES

PEACHES

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

Proper management

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

Proper management

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

Proper management

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

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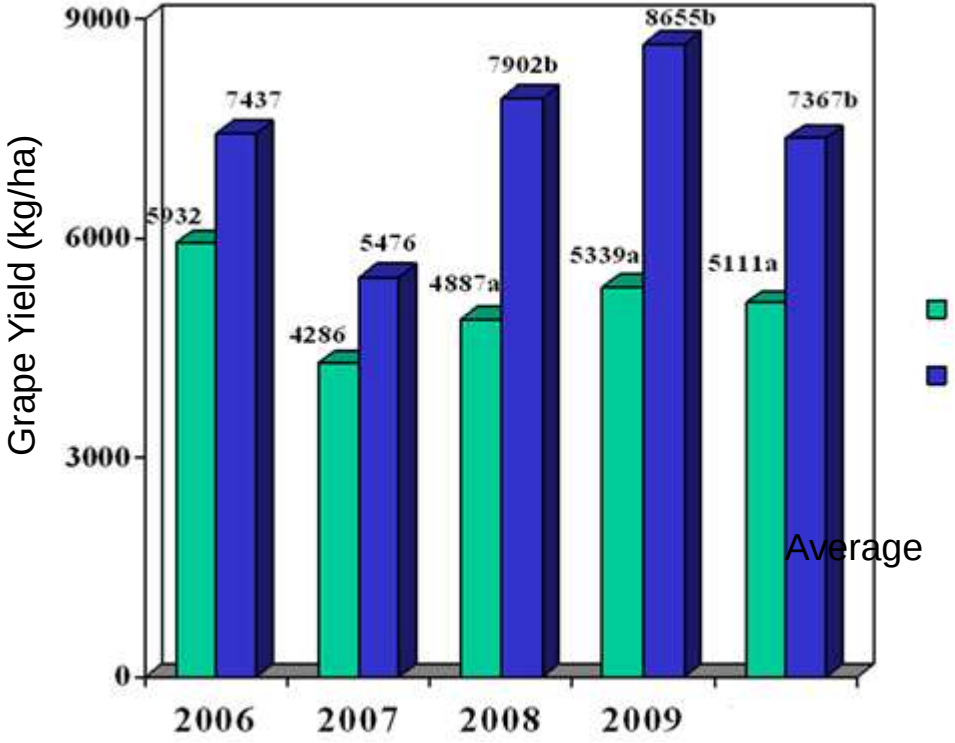
AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

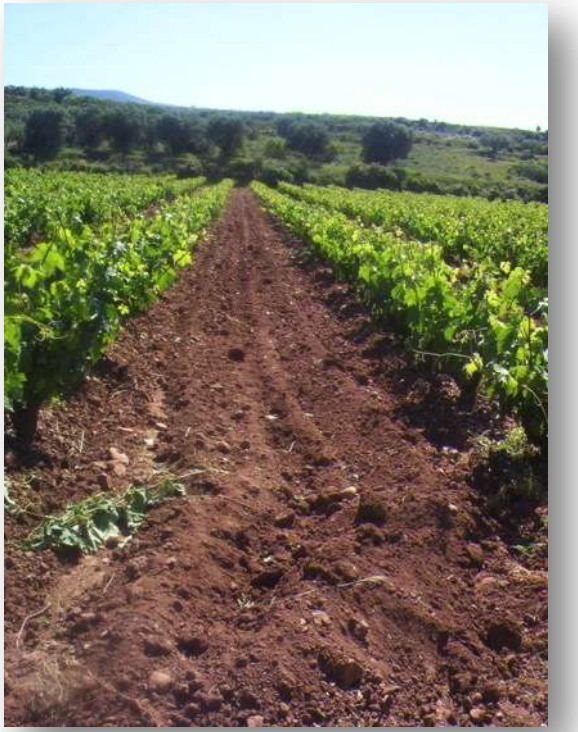
AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

Testing conducted by DAM in the field of direct application of sewage sludge to cropland

Agronomic recycling of WWTP sewage sludge on GRAPE CROPS in Logroño





Testing conducted by DAM in the field of direct application of sewage sludge to cropland

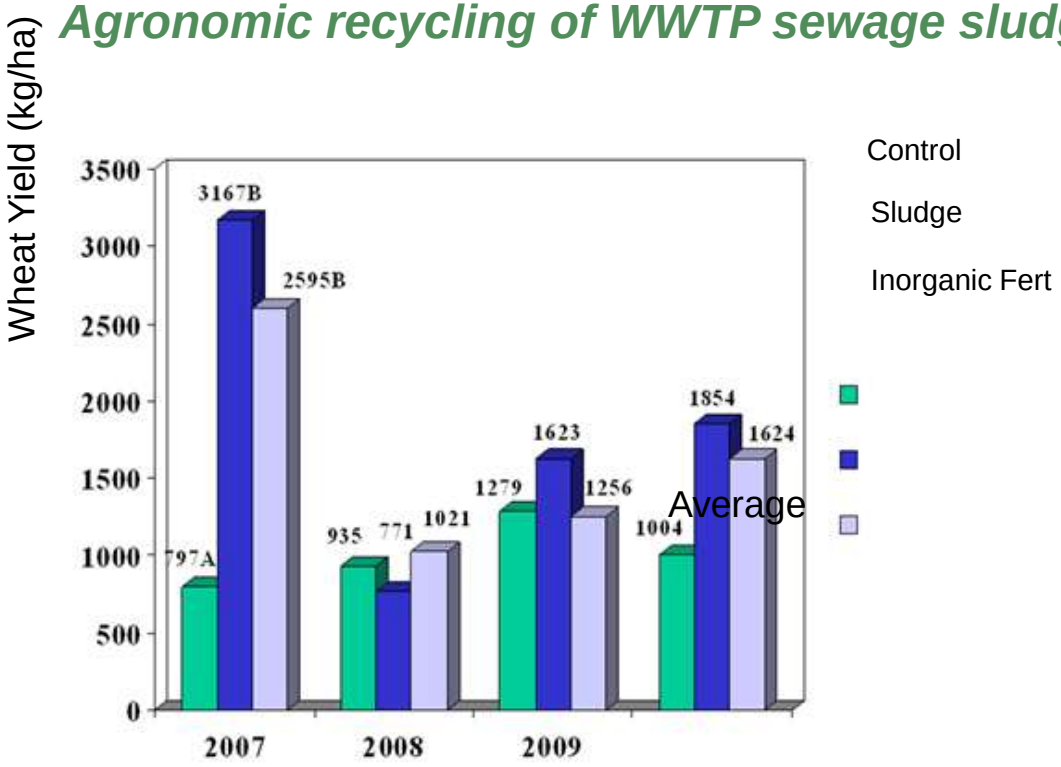
Agronomic recycling of WWTP sewage sludge on GRAPE CROPS in Logroño

- ✓ The application of sewage sludge increased grape production by 44% with respect to the control
- ✓ Grape quality was not affected (acidity and ºBrix)
- ✓ Sludge was applied in doses based on agronomic criteria, and did not pose any toxicity risk to the final product

AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

Testing conducted by DAM in the field of direct application of sewage sludge to cropland

Agronomic recycling of WWTP sewage sludge on CEREAL CROPS in Logroño



AGRICULTURAL APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE

Testing conducted by DAM in the field of direct application of sewage sludge to cropland

Agronomic recycling of WWTP sewage sludge on CEREAL CROPS in Logroño

- ✓ The grain yield of cereal fertilized with biosolids was:
  - 85% higher than control
  - 14% higher than inorganic fertilizer
- ✓ As these results show, the application of sewage sludge to agriculture is an interesting option

1. CHARACTERISTICS OF TREATMENT PLANT SEWAGE SLUDGE
2. PRODUCTION AND DISPOSAL OF TREATMENT PLANT SEWAGE SLUDGE
3. LEGISLATION APPLICABLE TO TREATMENT PLANT SEWAGE SLUDGE
4. APPLICATION OF TREATMENT PLANT SEWAGE SLUDGE TO AGRICULTURE
5. **TREATMENT PLANT SEWAGE SLUDGE MANAGEMENT COSTS**
6. CONCLUSIONS AND FINAL REMARKS

TREATMENT PLANT SEWAGE SLUDGE MANAGEMENT COSTS

Comparing investment and operating costs of the various sludge management options in Europe

TECHNOLOGY	Spain	United Kingdom	Denmark	Austria	Cost to the public
	Operating cost	Operating cost	Operating cost	Operating cost	
	€/ t WM	€/ t WM	€/ t WM	€/ t WM	
DRYING	50-70	69-184	74-107	-	energy subsidies, emissions
INCINERATION	51-74	103.5-184	98	45-180	Emissions
COMPOSTING	21-40	57.5-138	68	41.4-69	CO2 emissions, odors
DIRECT APPLICATION ON CROPLAND	15-20	34.5-92	-	23-115	Environmental risk and odors
LANDFILL DISPOSAL	70-120	46-138	-	-	CH4 emissions, odors, leachates, degradation of green spaces

- ✓ It is important to note that two instances of the same management option may have different operating costs, as they depend on the area where they are implemented

TREATMENT PLANT SEWAGE SLUDGE MANAGEMENT COSTS

Costs associated to the direct application of sewage sludge in

Item	Associated Factors	Remarks
Transport	Type of storage at WWTP	Gratly variable Represents 60% of overall cost
	Distance to cropland	
	Access to cropland	
	Fuel cost	
Soil Analyses	Size of site	According to applicable law, the cost of analyses (analysis of parameters and frequency) may be much higher.
	Applicable legislation	
	Soil type	
	Crop handling method	
Sewage sludge Analyses	Applicable legislation	According to applicable law, the cost of analyses (analysis of parameters and frequency) may be much higher.
Application to soil	% dry matter in sewage sludge to be applied	It is important to have specific equipment for application; manure spreading equipment rarely function properly
	Crop type	
Personnel	Technical personnel that prepare dosage reports, monitor processes and provide advice to farmers	Working with specialized personnel is essential
	Personnel needed for field sampling and monitoring	
Other associated costs	Licenses, permits, insurance, implementation of measures needed to ensure proper application	Direct application requires a permit as authorized waste manager Minimize any inconveniences that may arise from sludge application, which may increase costs
Administration and other	Administration, communications, maintenance	

1. CHARACTERISTICS OF TREATMENT PLANT SEWAGE SLUDGE
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5. SEWAGE SLUDGE MANAGEMENT COSTS
6. **CONCLUSIONS AND FINAL REMARKS**

CONCLUSIONS AND FINAL REMARKS

✓ It is important to move towards **integrated management of biosolids:**

- Good management of discharges to sewer systems
- Choose the best sewage sludge stabilization method possible
- Optimize drying of generated sewage sludge
- If post-treatment is necessary, try to integrate it into facility design
- Manage sewage sludge according to the following hierarchy of priorities:
  - 1. recycling (direct application or composting)
  - 2. Use for energy generation
  - 3. Disposal

CONCLUSIONS AND FINAL REMARKS

- ✓ If managed correctly and associated risks are kept to minimum, **sewage sludge from treatment plants** can be used as an **excellent organic amendment and fertilizer** for our soils

- ✓ To make the direct application of biosolids in agriculture **a sustainable agricultural practice**, it is important to have a **best practice manual or code** that can be applied right from the start of the management process, bearing in mind the costs that this entails.

- ✓ **"Copying" a management model isn't good enough**.

  Direct application of sewage sludge in agriculture is conditioned (economically, agriculturally and environmentally) by the characteristics of the area where it is to be applied.

CONCLUSIONS AND FINAL REMARKS

✓ WWTPs with **high sewage sludge production** should not use direct sewage sludge application in agriculture as their only sewage sludge management option.

It is advisable to have different management options (temporary storage plants, treatment plants) during periods in which sewage sludge uptake by agriculture will be low (climate conditions, periods of fertilization and crop handling, whenever application is inconvenient, etc.)

✓ Taking into account all the factors mentioned above, and always in the cases in which this option is feasible given the environmental conditions, the direct application of sewage sludge in agriculture is the most advantageous solution:

- Savings for the farmer
- Improved soil and crops
- Savings in management
- Environmental savings