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FINAL TRACE-REHAB PROJECT WORKSHOP

Tracing soil amendment impacts of processed wastewater sludge on the rehabilitation of Jordan's agro-pastoral areas (TRACE- Rehab)

Socio Economic Component: Achievements, Findings, Implications, and Way Forward

Boubaker Dhehibi (ICARDA-Tunisia) & Masnat Al Hiary (NARC-Jordan)
(On behalf of All Team Members)

June 24, 2021

Objectives of the Socio-Economic Component

Main Objective

- Investigate **farmers' perceptions,** their **acceptability**, and **beliefs** of land application of **treated biosolid** on their farms/**agro-pastoral communities** in Jordan

Specific Objectives

- Assessment farmer's attitudes towards the use of treated biosolids and compost
- Define potential factors influencing their willingness to use /or not this type of fertilizer (i.e., biosolid-based compost)
- Providing key potential factors influencing farmers to use or no use decisions.
- Have an idea about the types of fertilizers used in rainfed agriculture at Al Majeddyeh
- Knowledge on the drivers for adoption or rejection of using organic fertilizers in agriculture
- Have a clear idea about local production and marketing of organic fertilizers

Socio-Economic Component: Geographic Focus

Design/methodology/approach/Data

Design and Methodological Framework

- Mixed methods approach: Inferential statistical analysis & Focus groups discussion

Data Collection and Analysis

- Focus groups discussion / checklist list (16 Men)
- Rapid rural appraisal questionnaire (16 Men)
- Survey's questionnaires interviews (20 interviewed farmer’s)
- Direct observations in Al Majedeyyah

Practical Implications Emerging from this Research

- Ensure the capitalization of the existing opportunities to address the dual challenge of waste management and soil nutrient depletion in Jordan
- Safe recovery of nutrients from both solid and liquid waste streams for reuse in agriculture / Agro-pastoral farming systems (i.e., rangeland)

Achievements and Deliverables – Key Outputs

Type of deliverable	Deliverable	MEL Link
Focus Groups Discussion Report &	Focus Group Discussion Report Farmers' Attitudes Towards Biosolids use in Agriculture: Evidence from Jordanian *Badia*	https://dx.doi.org/20.500.11766/12244.
Socio Economic Survey Questionnaire Instrument	Socio Economic Survey Questionnaire Instrument أداة المسح الإقتصادي والإجتماعي	In Arabic: https://dx.doi.org/20.500.11766/11245 In English: https://dx.doi.org/20.500.11766/11252
Dataset	Farmers' Attitudes Towards Treated Sludge (Biosolids) use in Agriculture: Evidence from Jordanian *Badia*	https://hdl.handle.net/20.500.11766.1/FK2/F7QQYB
Technical Report	Farmers' Attitudes Towards Treated Sludge (Biosolids) use in Agriculture: Evidence from Jordanian *Badia*	https://dx.doi.org/20.500.11766/12537
Blog	PERCEPTIONS OF FARMERS TOWARDS TREATED SLUDGE (BIOSOLIDS): JORDANIAN BADIA CASE STUDY	Perceptions of farmers towards Treated Sludge (Biosolids): Jordanian Badia case study | IHE Delft Institute for Water Education (un-ihe.org)

Key Deliverables – Visualized Outputs

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Focus Group Discussion Report

Farmers' Attitudes Towards Biosolids use in Agriculture: Evidence from Jordanian Badia

Tracing soil amendment impacts of the biosolids on the rehabilitation of Jordan's agro-pastoral areas (TRACE Rehab)

Masnat Al Hiary[1], Omama Al Hadidi[1] , Boubaker Dhehibi [2]; Mira Haddad[3], and Stefan Strohmeier[3]

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December 2020

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Socio Economic Survey Questionnaire Instrument

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May 2020

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Socio Economic Survey Questionnaire Instrument
(أداة استبيان المسح الاجتماعي والاقتصادي)

Farmers' Attitudes Towards Treated Sludge use in Agriculture: Evidence from Jordanian Badia
مواقف المزارعين من استخدام المواد الصلبة الحيوية في الزراعة: دليل من البادية الأردنية

Tracing soil amendment impacts of processed wastewater sludge on the rehabilitation of Jordan's agro-pastoral areas (TRACE Rehab)

تتبع آثار تعديل التربة من المواد الصلبة الحيوية على إعادة تأهيل المناطق الزراعية والرعوية في الأردن

مسنات الحياري[1] بوبكر ذهيبي[2] ميرا حداد[3] ستيفان ستروهماير[3]

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ption: Horse With Trailer in Front of Petra Copyright: Abdullah Ghatasheh on Pexels.com

PERCEPTIONS OF FARMERS TOWARDS TREATED SLUDGE (BIOSOLIDS): JORDANIAN BADIA CASE STUDY

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Key Deliverables – Visualized Outputs

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Technical Report

Farmers' Attitudes Towards Treated Sludge (Biosolids) use in Agriculture: Evidence from Jordanian Badia

Photo credit: Dr. Hamzeh Rawashdeh (NARC-Jordan, 2020)

Tracing soil amendment impacts of processed wastewater sludge on the rehabilitation of Jordan's agro-pastoral areas (TRACE- Rehab)

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January 2021

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Key Deliverables – Visualized Outputs

Check List Instrument (FGD)

23 questions were in the discussion focus group checklist in addition to the general information about the community

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Focus Group Discussion Report

Farmers' Attitudes Towards Biosolids use in Agriculture: Evidence from Jordanian Badia

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(Draft version 1.0)

Focus Group Discussion Check List Instrument

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June 2020

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ANALYTICAL PROCESS & EMPIRICAL FINDINGS

Check List Instrument (FGD)

- General information
- Fertilizers and their uses
- Bio Solids Knowledge and Perception
- Impacts of using chemical fertilizers

Focus Group Discussion

General information

Al Majidyya

- Residents work in raising sheep(main job), some of them planting barley, military jobs, free professions, and governmental jobs.
- Educational level of the community is secondary, sub-secondary and 10% of the community has a bachelor's degree.
- Cooperative societies : There are two charities Associations (Al Majidyya Charitable Society for Men, Al-Mataba'a Charitable Society for Women)
- Total number of the population is about 300 individuals according to the farmers.
- Cultivated crops are barley and olives trees.
- only 5% of the community land considered as natural pastures due to frequent tillage, the types of plants which are familiar in the past in the community was Al-Shalwa (Avena Sterilis), Al-Qubbah (Eremopoa Persica) (a wild plant preferred by livestock), Al-Khafoor (Sisymbrium) (Schismus Arabicus Nees), Al-Qataf (Atriplex halimus), and Al-Otho (Anabasis Lachnantha).
- Sheep are grazing on pastures (crops/wild plants) (Nearly from 2 -3 months) while the rest of the months, farmers purchase fodder
- The average size of the land tenure is 30 – 50 dunums.

Focus Group Discussion

Fertilizers and their uses

The main types of fertilizers which farmers use is the dry manure and they consider it as organic fertilizer

The discussion revealed some factors influencing farmers' purchasing decisions of fertilizers such as:

- Price of fertilizer price
- Nutrient content
- Organic matter
- Knowledge of a person who used
- Country of origin

Focus Group Discussion

Bio Solids Knowledge and Perception

Farmers thought that using biosolids will affect the environmental situation in the community

Farmers Reasons for not willing to use biosolid in the rangelands

- Do not trust that biosolid is suitable;
- Concern about consumers attitude;
- Special needs are associated with biosolid use;
- Unpalatable to animals, as the animals refuse to get close to the area where there is biosolid.
- It is not accepted by the human soul.(harmful to humans and cause toxins)
- Contradicting religion and Sharia (religiously rejected).

Focus Group Discussion

Impacts of using chemical fertilizers

According to farmers the following are the impacts of using chemical fertilizers:

- Affect human health;
- Pollute the environment;
- It affects the soil due to the accumulation of salts and the depletion of large quantities of salts;
- Change the seed quality.

Socioeconomic survey

Questionnaire Instrument

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Socio Economic Survey Questionnaire Instrument (v1.0)

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April 2020

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Socioeconomic Survey

Questionnaire Instrument

First Part

- Socio Demographic Characteristics of the Household

Second Part

- Agriculture Farming System

Third Part

- **Farmers' Fertilizer use Patterns and Purchasing Behavior**
- **Factors Influencing Farmer's Fertilizer Purchasing Decisions**
- **The Use of Compost**
- **Sources and Preferences on the use of Fertilizers**

Case study of Majidyya Communities

First Part

- Socio Demographic Characteristics of the Household

Demographic Characteristics		Count	Percentage %
Sex	Male	20	100%
	Female	0	0%
Female Headed Household	Yes	0	0%
	No	20	100%
Age	Min. : 20	Max. : 70	Mean: 41
Marital status	Married	16	80%
	Single	4	20%
Educational level	Illiterate	1	5%
	Read and Write	1	5%
	Elementary	2	10%
	High School Graduate	13	65%
	B.S and Above	3	15%
Occupation	Farmer	9	45%
	Governmental Employee	2	10%
	Private Business	2	10%
	Dealer	1	5%
	Retired	6	30%
Family size	Min : 3	Max: 14	Mean: 7

Case study of Majidyya Communities

First Part

- Socio Demographic Characteristics of the Household

Survey Question	Answer	Count	Percentage %
Status of landownership	Do not own land	2	10%
	Own land	18	90%
Area Size	Min: 1	Max: 506	Median: 24 Mean: 96
Experience in Agriculture (Years)	Min: 4	Max: 44	Mean: 18
How long have you lived in this (Years) community?	Min: 1	Max: 54	Mean: 19
Are you a member of any farmer's association (cooperative, CBO, etc.)?	Yes	14	70%
	No	6	30%
How long have you enrolled by the association?	Min: 2	Max: 10	Mean: 7

Case study of Majidyya Communities

Second Part

- Agriculture Farming System

Survey Question	Answer	Count	Percentage
Do you have income other than agriculture?	No	6	30%
	Yes	14	70%
Sources of income other than agriculture	Governmental employee	2	14.3%
	Real estate's Dealer	1	7.1%
	Retirement	7	50%
	Private company	2	14.3%
	International organization(guard of project at Al Majidyya	1	7.1%
	Delivery and transport	1	7.1%
Income percentage %	Min: 20	Max: 100	Mean: 70
Percentage of income sources	Governmental employee		85%
	Real estate's Dealer		100%
	Retirement		average : 67%
	Private company		average : 83%
	International organization (guard of project at Al Majidyya)		30%
	Delivery and transport		50%
The main source of income	Livestock	9	30%, P. of cases: 45%
	Crop's planting	9	30% , P. of cases: 45%
	Private business	4	13%, P. of cases: 20%
	Employment (labor)	2	6.7%, P. of cases: 10%
	Retirement	6	20%, P. of cases: 30%

Case study of Majidyya Communities

Second Part

- Agriculture Farming System

Survey Question	Answer	Count	Percentage %
Net Household income ($/month)	Less than 1410 $	20	100%
Employment Status	Full- time Employment	4	13.8%, P. of cases: 20%
	Part - time Employment	3	10.3%, P. of cases: 15%
Do you own any farm land?	No	2	10%
	Yes	18	90%
Where?	Inside Al Majidyya	17	94%
	Outside Al Majidyya	1	6%
Do you rent any farm land?	No	10	50%
	Yes	10	50%
Where?	Al Majidyya	10	100%
What is the size of your rented land? (du)	Min: 30	Max: 500	Mean: 158 Median : 130
What is the size of your cultivated land? (du)	Min: 1	Max: 1006	Mean: 165 Median : 111

Case study of Majidyya Communities

Second Part

- Agriculture Farming System

Survey Question	Answer	Count		Percentage %
Size of olive land (du)	11 farmers	Min: 1	Max: 10	Mean: 4
Do you use organic fertilizer?	No	11		100%
	Yes	0		0%
No. of Times of using fertilizers/ year	11 farmers	Min: 1	Max: 2	Mean: 1.7
Specify of fertilizer type	Manure	11 farmers		100%

Case study of Majidyya Communities

Second Part

- Agriculture Farming System

Survey Question	Answer	Count		Percentage %
Size of Barley (du)	18 farmers	Min:2	Max:1000	Mean: 181 Median : 136
Uses of Barley	Grazing	16	69.6%	P. of cases: 88.9%
	Harvesting	5	21.7%	P. of cases: 27.8%
	Selling before harvesting (crop lease)	2	8.7%	P. of cases: 11.1%
No. of Grazing Sheep (head)		Min: 4	Max:800	Mean : 130 Median : 68
Duration of grazing (month)		Min: 1	Max:3	Mean: 2.6
Who used fertilizer for barley?	No Yes	15 3		83% 17%
Number of times of using fertilizer per year?	3	Min: 1	Max:1	Mean: 1

Case study of Majidyya Communities

Third Part

- Farmers' Fertilizer use Patterns and Purchasing Behavior
- Factors Influencing Farmer's Fertilizer Purchasing Decisions
- The Use of Compost
- Sources and Preferences on the use of Fertilizers

Case study of Majidyya Communities

- **Farmers' Fertilizer use Patterns and Purchasing Behavior**

Survey Question	Answer	Frequency	Percentage %
What type of fertilizers used on your land?	Manure	20	100%
Where do you get the manure fertilizers?	Own Farm	19	95%
	Bought	1	5%
Did you use chemical fertilizers?	No	19	95%
	Yes	1	5%
Did you use treated animal manure?	No	20	100%
What type of the manure used?	Fresh	20	100%
Are you satisfied with the existing sources of fertilizers?	No	4	20%
	Yes	16	80%
Did you heard about treated bio solids?	No	9	45%
	Yes	11	55%
Did you use treated bio solids before?	No	20	100%
What is your perception about treated biosolids use in agriculture?	Negative	15	75%
	Positive	5	25%
What is your perception about treated biosolids use to improve soil fertility of rangelands?	Negative	9	45%
	Positive	11	55%
Do you think that treated biosolids is good alternative to existing resources?	Definitely not	3	15%
	No	9	45%
	Do not know	5	25%
	Much	2	10%
	Very much	1	5%
Do you think that treated biosolids better than available resource?	Definitely not	4	20%
	No	8	40%
	Do not know	5	25%
	Much	2	10%
	Very much	1	5%

Case study of Majidyya Communities

- Factors Influencing Farmer's Fertilizer Purchasing Decisions

No.	Factors Influencing Farmer's Fertilizer Purchasing	Likert scale
1	Price of the fertilizer	Very influential
2	Nutrient content	Very influential
3	Organic matter	Very influential
4	Water-holding capacity	Very influential
5	Safety of fertilizer	Very influential
6	Packaging	Somewhat influential
7	Certification label	Somewhat influential
8	Brand name	Somewhat influential
9	Volumes to apply	Very influential
10	Fertilizer application	Very influential
11	Recommended by a trusted source	Very influential
12	Know someone who used it	Very influential
13	Product is locally made	Somewhat influential
14	Product is imported	Somewhat influential

Case study of Majidyya Communities

- The Use of Compost

Survey Question	Answer	Frequency	Percentage %
Type of fertilizer used	Organic	19	95%
	Chemical	1	5%
Do you ask reference authority about suitable fertilizer?	Yes	8	40%
	No	12	60%
Do you think that the extension agents give adequate information about the fertilization?	Yes	6	30%
	No	14	70%
The types of fertilizer you prefer	Organic	18	90%
	Chemical	2	10%
The types of fertilizer you can dispense	Organic	3	15%
	Chemical	17	85%
Type organic manure used	Fermented	2	10%
	Not fermented	18	90%
If the manure used is not fermented, do you know the environmental restrictions and regulations for the use?	Yes	5	28%
	No	13	72%
Have you an idea about the role of fermented organic manure environmental is pollution restriction?	Yes	10	50%
	No	10	50%
Source of fermented or non-fermented manure	From their Farm	18	90%
	Neighbor's farms	2	10%
If you produce organic fertilizer what type you make?	Plant residue	1	5%
	Manure	19	95
What is the best type of organic fertilizer you advices farmers to use?	Manure	11	55%
	Plant Residue	4	20%
	Manure& Plant Residue	5	25%
If you don't have any idea about the fermented manure advantage, And you knew its features will you use it?	Yes	20	100%
Do you think that fermented organic manure reduces desertification?	Yes	17	85%
	No	1	5%
	Don't know	2	10%
If your land is a sandy soil texture do you think that manure improves the water holding capacity and increase soil fertility?	Yes	18	90%
	Don't know	2	10%
Do you accept the use of other manufactures manure which manufactories from mixed biosolids?	Yes	4	20%
	No	16	80%

Case study of Majidyya Communities

- Sources and Preferences on the use of Fertilizers

Survey Question	Answer	Frequency	Percentage %
Who do you ask about suitable fertilizer?	Other farmers	3	15%
	Private Agricultural company	2	10%
	Ministry of Agriculture and NARC	15	75%

Survey Question	Answer	Frequency	Valid Percent	Percent
Why Do you prefer the use of chemical fertilizer?	The plant responds quickly to chemical fertilizers.	2	100%	10%
What are the problems facing farmers when using chemical fertilizer?	Harmful to plants and Soil	1	50%	5%
	Increase salinity	1	50%	5%
What about your opinion (Solutions)?	Use natural fertilizers and compost	1	50%	5%
	Decrease quantity of chemical fertilizer	1	50%	5%

Case study of Majidyya Communities

- Sources and Preferences on the use of Fertilizers

Survey Question	Answer	Frequency	Percentage %
If you prefer (fermented or non-fermented) organic fertilizer mention the reason?	Safe for health (not harmful)	2	10%
	Available and low cost	2	10%
	Increase productivity and improve product	12	60%
	Maintains the soil and conserve water	4	20%
What problems face to farmers when they use organic fertilizer or non organic fertilizer?	It increases insects and worms	6	30%
	Don't know how to make compost	6	30%
	Bad smell	5	25%
	Weeds appear	3	15%
What about your opinion? (solutions)	Do Experiment	6	30%
	Apply of the fermentation	10	50%
	Use pesticide	4	20%

Practical Implications

Factors influencing farmers' purchasing decisions of fertilizers such as:

- Fertilizer market price
- Nutrient content
- Organic matter
- Knowledge of a person who used
- Country of origin

Bio Solids knowledge and perceptions

- Do not trust that biosolid instead of sludge is suitable
- Concern about consumer's/foods attitude
- Special needs are associated with biosolid use
- Unpalatable to animals, as the animals refuse to get close to the area where there is biosolid
- It is not accepted by the human soul
- Contradicting religion and Sharia (religiously rejected)

Practical Implications

Chemical fertilizers use and perceptions

- Affect human health
- Pollute of the environment
- It affects the soil due to the accumulation of salts and the depletion of large quantities of salts
- Change the seed quality

Framers' suggestions to increase land fertility is:

- Stop using chemicals fertilizers
- Use of manure: Improves the soil and preserves moisture (i.e., soil is characterized by its high permeability, the manure added to the soil to conserve water and improve the soil texture)
- **While the fermented manure do not use it and they don't know the advantage of using it.**

Practical Implications

- Farmers' perception of land application of treated biosolids is negative in Al Majeddyeh region
- Reasons for no using treated biosolids are technical factors:
  - Do not trust that biosolids are suitable
  - Concerns on the use of these materials in the production of crops for human consumption
  - It is Harmful to animals and then to humans (transfer disease)
  - Sheep don't graze on barley inland treated with biosolids

  - Most critical factors influencing farmers' fertilizer purchasing decision are:
    - The safety of fertilizer, nutrient content, and organic matter
    - Water holding capacity
    - Recommendation by a trusted source and knowledge someone who used it
    - Volumes to apply, price of the fertilizer, and fertilizer application
    - There is a refusal to accept manure mixed with biosolids

Practical Implications

- The survey revealed that all respondent didn't use treated bio solids before, also the majority of respondents pay nothing for treated bio solids.
- In terms of accepting manure mixed with bio solids the majority of respondents refused manure mixed with bio solids and 20% accepted.
- Literature review reveals that farmers' concerns on biosolids use are primarily due to its anthropogenic origin, pollutants that it carries, and a general perception of treated biosolid being unsafe and risky.
- Overall, farmers' perception of land application of treated biosolids is negative, and the majority of the farmers don't want to use treated biosolids for several reasons such as their trust in the suitability of the treated biosolid;
- Concerns on the consumed product (transfer of disease); lack of knowledge on the biosolid properties and advantages and disadvantages of biosolids use in agriculture.

Practical Implications

- This study's findings are valuable for Jordanian decision-makers in their roles to promote the use of treated bio-solid as fertilizers and soil conditioners.

- The Agriculture and Extension Services in the Agriculture Ministry should encourage farmers to use treated biosolid in their community. Results suggest that land application of biosolid can be accepted by more farmers if farmers are well trained for the safe and effective use of treated biosolid.

- Launching awareness programs about the benefits of treated biosolids and improving farmers' perceptions on its land application; raising public awareness by holding training workshops and conducting surveys about the efficient application of treated biosolid.

Recommendations

- The **scarcity of organic fertilizers** and their **high prices** could **encourage** farmers to use treated biosolid instead of importing organic fertilizers
- The **limited experience** of using treated biosolid shows that farmers can accept it and deal with especially, if it is safe to handle and it is of good quality
- Treated biosolid should be **inexpensive, available** to farmers all the time and in **quantities they needed**

Way Forward

- A **demonstration of a model experimental farm** could be an excellent opportunity for the agro-pastoral communities to see the **benefits** of treated bio-solids in agriculture

- There is a need to **increase farmers' awareness** and perception of biosolids' benefits and impacts on land application.

- Conducting **additional research addressing farmers' concerns about public perception**, etc., and c**ommunicating** with **farmers** and **decision makers** about the **study results**

- Development of **new laws or regulations** to permit the production of biosolids and allow farmers to use them in agriculture

Power of Partnership: ICARDA & NARC TEAM

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ACKNOWLEDGMENTS

Special Thanks

The project team would like to thank all **NARC socio-economic**, technical team for their devotion and commitment to implementing this work.

We would like to acknowledge the participation of the **farmers** in all outlined studies areas and thank them for sharing with us their ideas and knowledge.

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Thank You

Comments – Questions