SINGLE-IMPACT FICHE
MANURE LAND APPLICATION TECHNIQUES

IMPACT: CROP YIELD

Data extracted in July 2021
Fiche created in February 2024

Note to the reader: This fiche summarises the effects of Manure land application techniques on CROP YIELD. It is based on 2 synthesis papers[1], including 40 and 85 primary studies.

1. WEIGHT OF THE EVIDENCE

CONSISTENCY OF THE IMPACT

Manure land application techniques have either non-significant or positive effects on crop yield, depending on the considered technique (**Table 1**).

The table below shows the number of synthesis papers with statistical tests reporting i) a significant difference between the Intervention and the Comparator, that is to say, a significant statistical effect, which can be positive or negative; or ii) a non-statistically significant difference between the Intervention and the Comparator. In addition, we include, if any, the number of synthesis papers reporting relevant results but without statistical test of the effects. Details on the quality assessment of the synthesis papers can be found in the methodology section of this WIKI.

- Land application with banding, compared to surface spreading/broadcasting: only one synthesis paper was available and this paper reported non-significant effect.
- Land application with deep placement or immediate incorporation, compared to surface spreading/broadcasting: 2 results out of 3 reported non-significant effect. However, 1 synthesis paper reported positive effect for deep placement of liquid manure, while reporting non-significant effect for immediate incorporation of solid manure.

Out of the 2 selected synthesis papers, one included studies conducted in Europe (see **Table 2**).

Table 1: Summary of effects. Number of synthesis papers reporting positive, negative or non-statistically significant effects on environmental and climate impacts. The number of synthesis papers reporting relevant results but without statistical test of the effects are also provided. When not all the synthesis papers reporting an effect are of high quality, the number of synthesis papers with a quality score of at least 50% is indicated in parentheses. The reference numbers of the synthesis papers reporting each of the effects are provided in **Table 3**. Some synthesis papers may report effects for more than one impact or more than one effect for the same impact.

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Increase crop yield	Crop yield	Land application with banding	Conventional management	0	0	1	0
		Land application with deep placement or immediate incorporation	Conventional management	1	0	2	0

QUALITY OF THE SYNTHESIS PAPERS

The quality of each synthesis paper was assessed based on 16 criteria regarding three main aspects: 1) the literature search strategy and primary studies selection; 2) the statistical analysis conducted; and 3) the evaluation of potential bias. We assessed whether authors addressed and reported these criteria. Then, a quality score was calculated as the percentage of these 16 criteria properly addressed and reported in each synthesis paper. Details on quality criteria can be found in the methodology section of this WIKI.

2. IMPACTS

The main characteristics and results of the 2 synthesis papers are reported in **Table 2** with the terminology used in those papers, while **Table 3** shows the reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**. Comprehensive information about the results reported in each synthesis paper, in particular about the modulation of effects by factors related to soil, climate and management practices, are provided in the **summaries of the synthesis papers** available in this WIKI.

Table 2: Main characteristics of the synthesis papers reporting effects on crop yield. The references are ordered chronologically with the most recent publication date first.

Reference number	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Ref4	Corn, Cotton, Forages,	Global	85	Poultry litter application with	Poultry litter broadcast	Crop	The fertilizer application method had non-significant effect	81%

[1] Synthesis research papers include either meta-analysis or systematic reviews with quantitative results. Details can be found in the methodology section of the WIKI.

Reference number	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
	Peanut, Rice. Soybean, Wheat			banding or soil incorporation	application	yield	on crop yield.	
Ref9	Maize, Soybean, Turnip rape, Winter wheat	Global	40	Liquid and Solid manure deep placement	Broadcast distribution of liquid manure	Crop yield	Manure placement effect on yield was non-significant for solid manure, while significantly positive for liquid manure.	88%

Table 3: Reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**.

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Increase crop yield	Crop yield	Land application with banding	Conventional management			Ref4	
		Land application with deep placement or immediate incorporation	Conventional management	Ref9		Ref4 and Ref9	

3. FACTORS INFLUENCING THE EFFECTS ON CROP YIELD

No factors were found.

4. KNOWLEDGE GAPS

Table 5: Knowledge gap(s) reported by the authors of the synthesis papers included in this review.

Ref Num	Gap
Ref4	Poultry litter application method was generally associated with a particular tillage system. For instance, surface broadcast and subsurface band application was associated with no-tillage or strip tillage, whereas broadcast incorporation was associated with conventional tillage. Due to the limited studies obtained from our literature search for both tillage techniques vs. the poultry application methods, the authors did not analyze the interactions between those management strategies.

5. SYNTHESIS PAPERS INCLUDED IN THE REVIEW

Table 6: List of synthesis papers included in this review. More details can be found in the summaries of the meta-analyses.

Ref Num	Author(s)	Year	Title	Journal	DOI
Ref4	Lin, YR; Watts, DB; van Santen, E; Cao, GQ	2018	Influence of Poultry Litter on Crop Productivity under Different Field Conditions: A Meta-Analysis	Agron. J. 807–18	10.2134/agronj2017.09.0513
Ref9	Nkebiwe, PM; Weinmann, M; Bar-Tal, A; Muller, T	2016	Fertilizer placement to improve crop nutrient acquisition and yield: A review and meta-analysis	Field Crops Research 196, 389-401	10.1016/j.fcr.2016.07.018

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