Original Research Article

An Evaluation of Recycled Papers as Storage and Germination Medium of Vegetable Seeds

ABSTRACT

Recycled papers embedded with seeds provide an innovative approach for storing and germinating seeds. This quantitative study was conducted to evaluate the viability and germination of vegetable seeds in recycled paper compared to soil. Pechay (*Brassica rapa*), mustard (*Brassica juncea*), spinach (*Spinacia oleracea*), and saluyot (*Corchorus olitorius*) were seed samples examined in both media. Seedlings' height and germination count were monitored using a counting method and measured by rulers daily, with even sprays of water. As a result, viability varied among seeds, with pechay (100%) and mustard (96.30%) showing higher rates in recycled paper than spinach (25.93%) and saluyot (44.44%). Soil generally yielded better viability in pechay (96.30%), mustard (96.30%), spinach (96.30%), and saluyot (70.37%). Germination rates differed across seed types and media. Pechay and mustard displayed consistent growth in both media, while spinach and saluyot exhibited slower growth with varied patterns. Statistical analysis using the Fisher Exact Test and T-test showed no significant viability difference between recycled paper and soil (P = 0.214). Soil remains preferred, but recycled paper can serve as an alternative starting medium. Long-term growth assessment and matching media to more plant species are recommended to enhance germination practices and sustainable agriculture.

Keywords: Germination Rate, Recycled Paper, Soil, Vegetable Seeds, Viability

1. INTRODUCTION

Significant quantities of paper waste have been accumulated in recent years due to environmental concerns, highlighting the need for reuse and recycling, much like the varying lifespans of seeds, which depend greatly on species despite identical treatment and storage conditions [1,2]. Meanwhile, with wasted paper and paper products constituting over a third of landfill waste, the paper industry generates significant quantities of waste, contributing to landfill overflow [3,4]. However, recycled paper fibers offer a sustainable solution by binding the soil particles together, preventing them from being washed away by water or blown away by wind [5].

Seed germination and storage methods are crucial for optimal plant growth and sustainable agriculture [6]. While soil and peat have been traditionally used, there is a growing need for ecological alternatives. Recycling paper offers sustainability benefits, saving trees and water while reducing manufacturing costs. It is biodegradable and environmentally friendly [7,8]. Including various vegetable seeds like pechay, saluyot, spinach, and mustard greens expands the study's scope [9].

In the agricultural landscape, leafy greens like pechay in the Philippines provide a valuable source of income for farmers, with their rapid 30-45 day harvesting cycle [10]. There are studies that examine methods like organic foliar fertilization to optimize pechay yield. Additionally [11], crops like spinach are gaining global popularity due to their nutritional benefits, despite potential health concerns like

nitrate-induced methemoglobinemia [12,13]. Meanwhile, mustard, rich in phytochemicals and nutrients, contributes to the diverse array of crops cultivated worldwide [14]. Jute cultivation showcases versatility, thriving in various intermediate soils, except for extreme sand or clay compositions. [15,16]

The study investigated the viability and germination rates of four vegetable seeds in recycled paper versus soil, aiming to highlight differences in germination mediums. This study could empower urban dwellers to engage in sustainable living, bridging everyday actions with environmental responsibility. Additionally, it contributes to resource efficiency discussions, advocating for creative material reuse.

2. METHODOLOGY

This study employed a true experimental research design that aimed to investigate the viability and germination rate of recycled papers derived from seed calendar as opposed to soil. It took 10 days to test and compare the germination rates and viability of vegetable seeds (pechay, mustard, saluyot, and spinach) in both media. The parameters of this study were the seeds' height, the number of days they sprouted, and the germination count. These were monitored by counting and measuring by using calibrated rulers every afternoon for 10 days. The mediums were evenly sprayed with water; each received 30 sprays. Additionally, a T-test for two independent means and a Fisher's exact test were applied to assess whether there is a significant difference between the viability and germination rates of vegetable seeds in recycled papers and soil.

3.1 The Viability of Four (4) Vegetable Seeds Using Recycled Paper and Soil as Germination Medium

3. RESULTS AND DISCUSSION

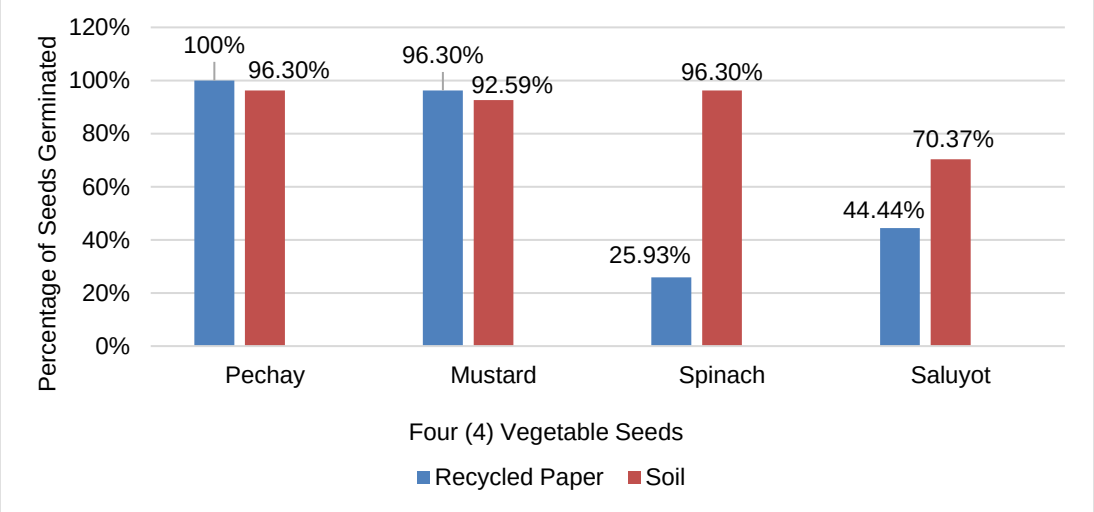

Figure 1. The Percentage Distribution of The Viability of Four (4) Vegetable Seeds

The analysis revealed that both pechay and mustard seeds showed greater viability in recycled paper compared to soil. Contrary to spinach and saluyot, which both show a preference for soil. This highlights the significant influence of the germination medium on seed viability, suggesting different preferences among the seeds.

3.2 The Germination Rate of Four (4) Vegetable Seeds Using Recycled Paper and Soil as Germination Medium

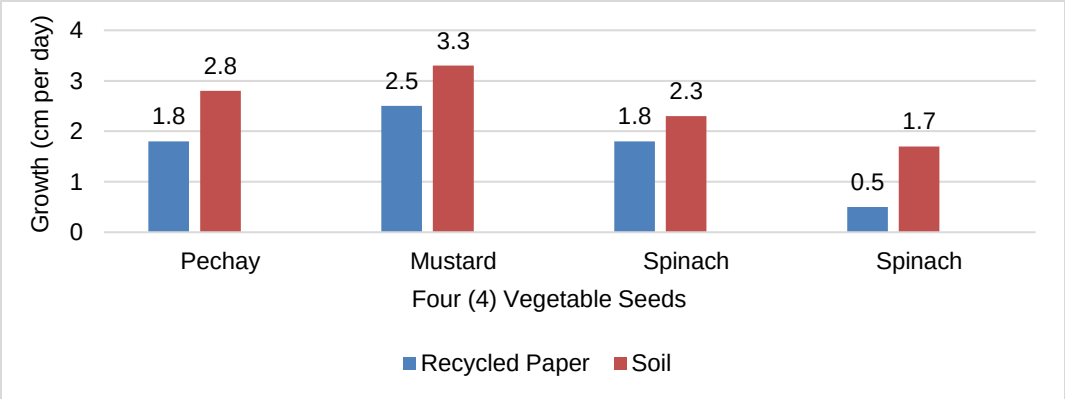

Figure 2. The Germination rate of Four (4) Vegetable Seeds using Recycled Paper and Soil as Germination Medium

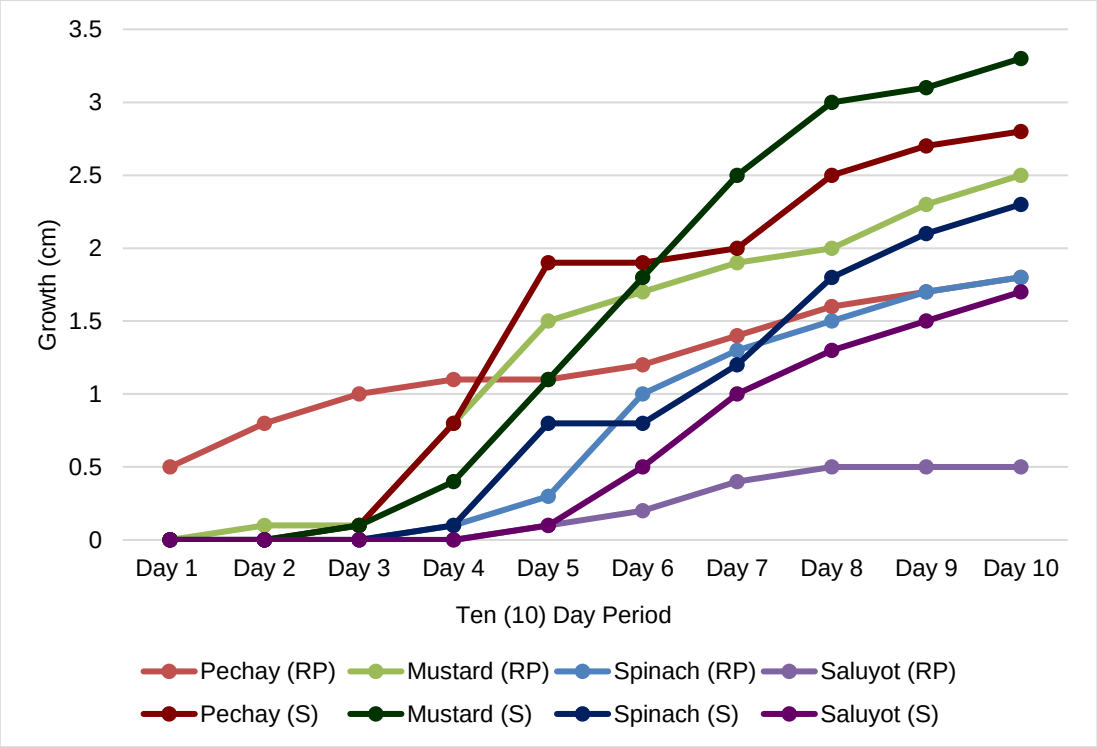

Figure 3. The Growth of Plants from Day 1-10 using Recycled Paper and Soil

Analysis revealed that mustard seeds demonstrated exceptional rate of germination in both recycled paper and soil, followed by pechay, spinach, and saluyot, respectively. However, since this study solely focused on vegetable seeds, further exploration with diverse seed varieties is warranted, indicating mustard seeds' superior adaptability for germination in various mediums. Overall, plants in soil consistently exhibit taller heights, indicating healthier growth compared to those in recycled [17]. The adoption of sustainable practices is likely to help achieve more resilient and productive food systems and enable sustainable production, which would serve to reduce poverty and advance food security [18].

3.3 The Difference in Viability and Germination Rate of Four (4) Kinds of Vegetable Seeds using Recycled Paper and Soil as Germination Medium

The analysis revealed using Fisher's exact test that there was no significant difference in viability between the two media, with (P = 0.21), which is above the level of significance 0.05. Both recycled paper and soil are equally effective in supporting the germination and growth of the seeds tested. The different types of seeds showed similar viability rates across both media.

Table 1. Difference in Growth between Recycled Paper and Soil as Germination Medium

Difference	Medium	Mean (cm)	SD	Mean Difference	t-value	p-value	Remarks
Pechay	Soil	2.83	1.37	1.07	3.73	0.001	Significant
	Paper	1.76	0.91				
Mustard	Soil	3.27	1.61	0.76	1.953	0.057	Not Significant
	Paper	2.51	1.13				
Spinach	Soil	2.28	0.83	0.46	1.304	0.202	Not Significant
	Paper	1.83	0.77				
Saluyot	Soil	1.67	0.50	1.18	7.573	0.0001	Significant
	Paper	0.49	0.23				

With 0.05 level of significance

The germination rates varied depending on the medium. For pechay and saluyot, growth differences were statistically significant (P = 0.001) and (P = 0.0001). pechay thrived better in soil, while saluyot showed superior growth in recycled paper. Conversely, for mustard and spinach, the differences were not statistically significant (P = 0.057) and (P = 0.202), suggesting that the choice of medium does not notably affect their growth.

4. CONCLUSION

The four plant types showed distinct preferences between soil and recycled paper for germination. Pechay and mustard seeds thrived on recycled paper with germination rates of 100.00% and 96.30% respectively, surpassing those on soil. In contrast, spinach and saluyot seeds preferred soil, exhibiting higher viability rates of 96.30% and 70.37% respectively. Despite recycled paper's limitations, it emerges as a promising alternative for seed germination, suggesting its potential for waste reduction and environmental conservation. While germination rates vary, the growth outcomes indicate the comparable viability of recycled paper as a sustainable planting medium.

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