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An economic evaluation of a long-term experiment on phosphorus and manure amendments to sandy Sahelian soils: using a stochastic dominance model*

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Abstract

Poor fertility status of sandy Sahelian soils represents a major constraint to cereal and legume production. Soil amendment options were evaluated, using a stochastic efficiency framework. Dominance analyses showed that in the presence of annual applications of 30 kg N ha^{-1} and 30 kg K ha^{-1}, efficient soil amendment options comprise of either the annual application of 8.7 kg P ha^{-1} in the form of single superphosphates in combination with 5 tonnes manure ha^{-1} applied every three years or the annual application of 17.5 kg P ha^{-1} in the form of single superphosphates. Choice between these two efficient options depends on the availability of manure, deficiencies in sandy soils and farmer resource endowments.

Résumé

Une evaluation economique d'un essai a long-terme sur les amendements des sols sablonneux Saheliens par l'application du phosphore et du fumier: L'application du model de dominance stochastique.

Le bas niveau de la fertilité des sols sableux Sahéliens constitue un obstacle majeur à la production des céréales et des legumineuses. Differents amendements ont été évalués dans le cadre d'une efficacité stochastique. Les analyses de dominance ont montré qu'en presence de l'application annuelle de 30 kg N ha^{-1} et 30 kg K ha^{-1}, les options d'amendement des sols sableux, les plus efficaces, sont l'application annuelle de 8.7 kg P ha^{-1} sous forme de SSP et 5 tonnes du fumier ha^{-1} tous les trois ans où l'application annuelle de 17.5 k de P ha^{-1} sous forme de superphosphate simple. Un choix parmi les deux, dépend de la disponibilité en fumier, les carences des sols sableux et les ressources du ménage.

Introduction

In rainfed agriculture in the Sahel, crop productivity is limited by low and highly variable rainfall, as well as the poor physical and chemical characteristics of the predominantly sandy soils. Literature on soils of the region show phosphorus and nitrogen deficiencies. However, phosphorus deficiency tends to be more important than that of nitrogen [10, 12]. Research has shown that nitrogen improved millet yields only in the presence of adequate phosphorus [5, 6].

This paper presents an economic evaluation, within the framework of expected level of satisfaction (expected utility), of a number of soil

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amendment options for sandy soils tested in a long-term on-station trial in Niger. Comparisons of data from such a long-term experiment permit good relative assessment of appropriate means of improving soil conditions for higher crop production. Also, yields assessed over widely varied seasonal growing conditions permit the incorporation of more reliable risk information that are useful for making efficient choices.

In the Sahel, feasible soil amendment options include the application of animal manure and/or inorganic fertilizers to farmlands. Widespread use of animal manure is limited by availability in adequate amounts, while the use of inorganic fertilizers is constrained by high import costs, foreign exchange scarcities and opportunity costs. While nitrogen and potassium must be imported, phosphate rock (PR) deposits exist in some African countries and are thought to provide economic alternatives to imported soluble phosphorus fertilizers [3] such as single superphosphate (SSP). However, the effectiveness of PR depends on its chemical and mineralogical composition, soil factors and plants grown [7]. Due to the low reactivity of PR found in many African countries, the technology of partially acidulating PR was developed to improve its agronomic effectiveness. The factory gate cost of P from sulphuric acid-based 50% partially acidulated phosphate rock (PAPR) is estimated at only 80% the costs of P obtained from SSP [14]. Additionally, since sulphur deficiency occurs if soils are intensively cultivated [16], the treatment of PR with sulphuric acid could confer the benefit of resolving such deficiencies.

Materials and methods

Experimental site, materials and design

A soil amendment trial was conducted at Sadoré, near Niamey, in Niger from 1984 to 1989. The experiment was started on land from which the natural vegetation has just been cleared. Soils at the experimental site were derived from eolian sand deposits and have a topsoil layer made up of 94% sand and 2% clay. Other characteristics of the soils are: pH of 5.4 (1:1 H_2O), CEC of 0.9 cmol(+) kg^{-1} and organic matter of 2 gram kg^{-1}. In the USDA soil classification system, soils of the experimental site are sandy psammentic paleustalf, siliceous and isohypermic [18].

The experiment was designed to evaluate the comparative value of applying different levels of manure and/or P from PR, PAPR or SSP sources, to sandy soils of the Sahel. Soil amendment options tested in the experiment consisted of the application 5 tonnes manure ha^{-1} or 20 tonnes manure ha^{-1} every three years and/or the application of P in the form of PR, 50% PAPR or SSP. The chemical characteristics of samples of the manure used were: 32.1% organic matter, 0.405% total P, 1.21% total N and pH (KCL) of 7.7. The times of application and the quantities of inputs used in the nine treatments that received P and/or manure applications in the experiment are presented in Table 1. All treatments, including the control, received annual applications of 30 kg N ha^{-1} from Urea and 30 kg K ha^{-1} from KCL. The background rates of application of N and K may seem high but are inexpensive and hence affordable, even though fertilizers are rarely applied in traditional millet production systems of the Sahel. Animal traction was used to incorporate P, K and manure applied, prior to planting. Half of the N was applied around 21 days after sowing while the remaining half was applied around 42 days after sowing. There were eight replications per treatment, on plot size 64 m^2, in a randomized complete block design.

Pearl millet (*Pennisetum glaucum* L. c.v. CIVT) was planted at a spacing of one meter by one meter. Therefore, the plant density was 10,000 pockets per hectare. At around 15 days after planting, the millet stands were thinned to three plants per pocket.

Data collected

Rainfall amount and distribution are important indices of growing conditions in the Sahel. Unpredictable and variable rainfall in the Sahel is often cited as the reason for frequent crop failure [15]. Moreover, rainfall amount and distribution affect the effectiveness of soil amendments. The amount and distribution of rainfall over the trial period (1984 to 1989) varied from a severe drought in 1984, when no grain yields were

Table 1. Treatments and per hectare input levels

Treatments	Year 1984	1985	1986	1987	1988	1989
Man5[a] (tonnes)	5			5		
Man20 (tonnes)	20			20		
SSP8.7[b]: P applied (kg)	8.7	8.7	8.7	8.7	8.7	8.7
SSP17.5: P applied (kg)	17.5	17.5	17.5	17.5	17.5	17.5
PR39.3[c]: P applied (kg)	39.3	39.3	39.3	39.3	39.3	39.3
SSP8.7 + Man5: P applied (kg)	8.7	8.7	8.7	8.7	8.7	8.7
Man (tonnes)	5			5		
SSP17.5 + Man20: P applied (kg)	17.5	17.5	17.5	17.5	17.5	17.5
Man (tonnes)	20			20		
PAPR8.7[d] + Man5: P applied (kg)	8.7	8.7	8.7	8.7	8.7	8.7
Man (tonnes)	5			5		
PR39.3 + Man5: P applied (kg)	39.3	39.3	39.3	39.3	39.3	39.3
Man (tonnes)	5			5		

[a] Man5 denotes application of 5 tonnes manure ha^{-1}. Similarly, Man20 denotes application of 20 tonnes manure ha^{-1}.
[b] SSP8.7 denotes the application of 8.7 kg P ha^{-1} from SSP. Similarly, SSP17.5 denotes the application of 17.5 kg P ha^{-1} from SSP.
[c] PR39.3 denotes the application of 39.3 kg P ha^{-1} from PR.
[d] PAPR8.7 denotes the application of 8.7 kg P ha^{-1} from 50% PAPR.
Note: In addition, all treatments including the control received yearly amendments of 30 kg N ha^{-1} and 30 kg K ha^{-1}.

recorded on all plots, to above normal rains in 1988 (Table 2). With the exception of 1984, intra-seasonal rainfall distributions were not unexpectedly skewed in the trial years. Therefore, only total seasonal rainfall amounts were collected for use as source of probabilistic data. Moreover, there is no single variable that can effectively capture intra-seasonal rainfall distribution. Additionally, the decision to use total seasonal rainfall amounts as sources of probabilistic data was based on lack of evidence of large carryover effects, when yield differences between treatments that involved the application of manure were compared. For example, yield differences that occurred in 1985 and 1988, between the application of five tonnes manure ha^{-1} every three years and the application of 20 tonnes manure ha^{-1} every three years, were compared. However, no strong carryover evidence was observed in the comparisons. Nevertheless, where some carryover of nutrients occurred, the amounts are dependent on quantities of nutrients used up for crop growth during the preceeding season and hence conditional upon seasonal rainfall of that preceeding season. Therefore, seasonal rainfall amount remains a useful single source of probabilistic data.

In addition, six years of grain yield data, post-harvest market prices for pearl millet grains as well as inorganic fertilizer and manure cost information were used in this paper to evaluate the relative effectiveness and economic efficiency of soil amendment options tested.

Analytical method

Farmers can be assumed to want to maximize satisfaction from expected net returns to investments on their farms. Therefore, they would want to choose only the most efficient soil amendment option. In this paper, the conceptual criterion for making efficient choices, using expected utility framework, is stochastic dominance [17]. The underlying behavioral assumption in searching for stochastic efficiency is that dominated distributions will not be preferred by expected utility maximizing farmers. Net returns to a treatment A are said to be dominated if, at all or most similar probabilities of occurrence, they are lower than net returns to another treatment B.

Calculation of subjective probabilities

The use of stochastic efficiency concept requires the specification of lower tails of probability distribution of outcomes. An important component of stochastic dominance is the source of the probabilistic data [17]. In view of the effect of rainfall amount on effectiveness of soil amendments and crop yields in the Sahel, probabilities of seasonal rainfall received during the six-year

Table 2. Rainfall data for Niamey area of Niger from 1984 and 1989

	Months June	July	August	September	Seasonal totals
1984					
Rainfall (mm)	42	91	56	26	215
Number of rainy days	4	8	5	7	
Probability					0.01
1985					
Rainfall (mm)	75	136	249	82	542
Number of rainy days	7	9	12	7	
Probability					0.48
1986					
Rainfall (mm)	61	176	189	119	545
Number of rainy days	6	9	11	11	
Probability					0.24
1987					
Rainfall (mm)	15	82	225	56	378
Number of rainy days	2	12	8	7	
Probability					0.79
1988					
Rainfall (mm)	91	173	238	186	688
Number of rainy days	8	9	13	10	
Probability					0.17
1989					
Rainfall (mm)	35	92	234	198	559
Number of rainy days	4	7	12	10	
Probability					0.31
Long-term rainfall data					
Rainfall (mm)	76	143	192	90	501
Number of rainy days	7	10	13	8	

Note: The probability corresponding to 1984, for example, suggests that there is only 1% chance of getting 215 mm of rain or less.

period were computed from over 80 years of data for the Niamey area of Niger.

To capture the influence of any nutrient carryover from one year to the next, joint rainfall probabilities were calculated, instead of directly using annual rainfall probabilities. For years A and B, the joint probability is calculated from the formula: $P(BA) = P(A) \times P(B/A)$, where $P(B/A)$ is the conditional probability of B given A. Since annual rainfall amounts are independent, joint rainfall probability calculation for any two years is simply the probability of rainfall amount received in one year multiplied by the rainfall probability for the preceeding year {i.e. $P(BA) = P(A) \times P(B)$}.

Since 1984 was the first year of experimentation, it was assigned a subjective probability equivalent to its objective rainfall probability (0.01). For the remaining years of experimentation, the calculated joint rainfall probabilities were used to guide proportional assignment of subjective probabilities to net returns of corresponding years. The joint rainfall probability corresponding to each year was divided by the sum of all the joint rainfall probabilities and the result was then multiplied by subjective probability of 0.99 that remained to be assigned. For example, annual rainfall probabilities for 1984 and 1985 are 0.01 and 0.48, respectively. The joint rainfall probability for 1985 (given 1984 rainfall probability) is 0.0048. This was first divided by the sum of all the joint probabilities (0.497) and then multiplied by subjective probability of 0.99, that remained after the deduction of the subjective probability of 0.01 assigned to 1984.

Calculation of net returns and cumulated probabilities

Farmers generally transport manure to their fields well before the rainy season, when family labor opportunity costs are low [9]. Therefore, the important constraints to the use of soil amendments by farmers are: input cost or availability, lack of funds and the opportunity cost of available household funds.

Unit costs of inorganic fertilizers and manure[1] were multiplied by the quantities of soil amendments used and the total costs were deducted from corresponding gross values of yields. The net returns for each soil amendment option were arranged in ascending order and the probabilities associated with the years of occurrence were successively cumulated. For example, the ascending order of net returns distribution for the control is: −8, 1, 10, 23, 27 and 28; and the subjective probability corresponding to each of these returns is: 0.01, 0.106, 0.267, 0.01, 0.229 and 0.378, respectively. The sequence of cumulative probabilities assigned to the ascending order of net returns for the control is: 0.01, 0.116, 0.383, 0.393, 0.622 and 1, respectively.

Assessment of stochastic efficiency

Two necessary conditions for dominance were used to identify inconclusive comparisons, where sets of net return distributions violated at least one of the two conditions. The necessary conditions are that the mean of the dominant distribution should be greater and that its smallest value cannot be less than the smallest value of the dominated distribution [1,2]. Where both necessary conditions were satisfied by two net return distributions, two steps were used to determine the type of dominance. If net return distribution A does not lie anywhere to the left of net return distribution B, then the dominance of B by A is said to be first degree (FSD). Where net returns distributions cross and net return distribution C lies more to the right of net return distribution D, in terms of differences in area between curves cumulated from the lower values of net returns, then dominance of net return distribution D by net return distribution C is by second degree (SSD). All dominated options are inefficient and hence deleted from further comparisons in which the concept of partial FSD was used.

Results and discussion

Table 3 presents annual grain yields for all the ten treatments in the experiment. The interaction of natural soil fertility of newly cleared land which has been cropped only once, excellent rainfall in 1985 and possible nutrient carryovers may explain the generally higher millet grain yields obtained in 1985. Generally, the grain yield data show a downward yield trend on the experimental plots, probably due to

Table 3. Pearl millet grain yields and November market prices

Treatments	Grain yields[a] ($kg\ ha^{-1}$)				
	1985	1986	1987	1988	1989
Control	416	502	580	362	209
Man5	1122	593	772	723	356
Man20	1735	1544	1265	1457	708
SSP8.7	1103	882	594	734	408
SSP17.5	1335	1379	820	851	575
PR39.3	1101	842	675	485	284
SSP8.7 + Man5	1589	1379	990	1093	530
SSP17.5 + Man20	1464	1873	1226	1508	865
PAPR8.7 + Man5	1293	1027	789	926	423
PR39.3 + Man5	1376	1303	999	952	497
Overall means	1253	1132	871	909	486
SE ±	78	81	58	90	42
Millet prices FCFA/kg:	75	70	63	51	45

[a] The data were obtained from the soil fertility program of the International Fertilizer Development Company (IFDC), at the ICRISAT Sahelian Center.

Note: although there was millet vegetative growth in 1984, no grain yields were obtained due to drought.

declining soil organic matter content. This is consistent with long-term soil fertility experiments in Burkina Faso that showed that in the absence of substantial additions of organic matter, continuous applications of inorganic fertilizers can reduce soil production potential as acidification and deficiencies in micro-nutrients occur [11].

During the period of experimentation, the post-harvest price millet data show a declining trend (Table 3). This could be attributed to the effects of the levels of imports and donations of substitute grains, on post-harvest millet grain prices.

As expected, grain yields were lowest for the control where no manure or P was applied. On the other hand, the best yields were obtained where 20 tonnes of manure ha^{-1} were applied every three years either sole or in combination with annual application of 17.5 kg P ha^{-1} from SSP. Also, superior grain yields were obtained if five tonnes of manure ha^{-1} were combined with P than where either P or manure was applied sole. More importantly, incremental yields, over the control, for a combination of P from PR and manure were larger than the sum of incremental yields for the individual components in every year except 1985. Therefore, simultaneous use of organic and inorganic soil amendments exploit complementary roles and permit higher crop yields. However, where 20 tonnes of manure ha^{-1} were applied, an additional application of 17.5 kg P ha^{-1} in the form of SSP did not result in high yield increases, except in 1986. The implication is that where farmers can apply 20 tonnes of manure ha^{-1} every three years, supplementary application of P may not be necessary. This also suggests that significant synergy occurs only at some levels of P and manure combination and that reliance on organic sources of soil nutrients to complement chemical fertilizers is needed [8]. In addition, the use of manure cuts down on the quantities of imported chemical fertilizer and hence saves foreign exchange [13,4].

Since farmers have to purchase inputs and the costs of inputs used in the treatments differ, they would be interested in comparing relative net returns and their probabilities of occurrence. Grain yields were, therefore, valued at post-harvest market prices for pearl millet. Net returns were calculated by deducting manure and inorganic fertilizer input costs from the value of yields. The distribution of net returns and associated subjective probabilities which were used for pairwise comparisons of soil amendment alternatives, within the stochastic dominance framework are presented in Table 4. Stochastic efficiency comparisons of net return distributions and associated cumulative subjective probabilities show that net return distribution for SSP8.7 + MAN5 does not lie anywhere to the left of net return distribution for PR39.3 + MAN5 (Fig. 1). Therefore, dominance of

Table 4. Empirical distributions of annual net returns and probabilities

Treatments	Year 1984	1985	1986	1987	1988	1989
	×1000 FCFA ha^{-1}					
Control	−8	23	27	28	10	1
Man5	−28	76	33	20	28	8
Man20	−88	122	100	−9	66	23
SSP8.7	−13	69	48	23	23	4
SSP17.5	−18	81	77	32	24	6
PR39.3	−15	67	43	27	9	−3
SSP8.7 + Man5	−34	105	83	28	42	10
SSP17.5 + Man20	−100	90	112	−22	57	19
PAPR8.7 + Man5	−32	84	59	17	34	6
PR39.3 + Man5	−35	87	75	27	33	6
Rainfall prob.:	0.01	0.48	0.24	0.79	0.17	0.31
Joint rainfall prob.:	–	0.005	0.115	0.19	0.134	0.053
Subjective prob.:	0.01	0.01	0.229	0.378	0.267	0.106

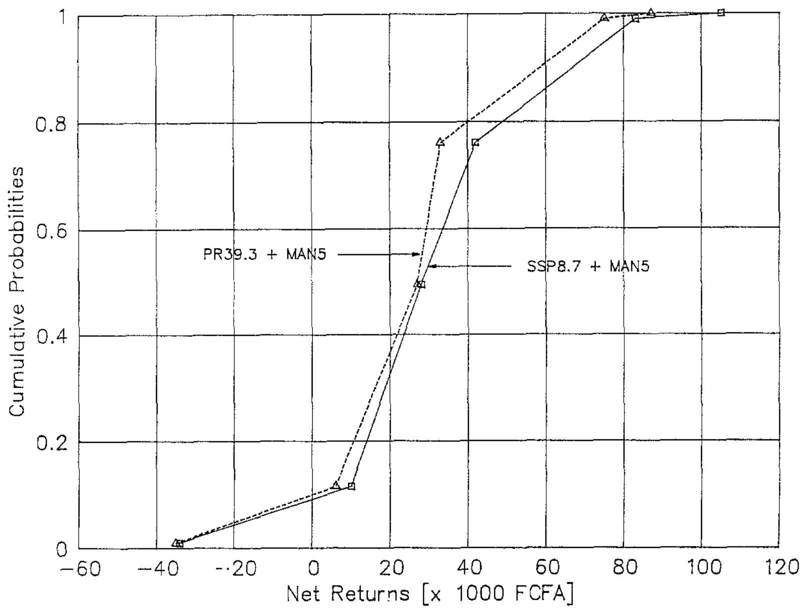

Fig. 1. First-degree stochastic dominance of combination of 5 tonnes manure ha^{-1} plus annual 8.7 kg P ha^{-1} from SSP over combination of 5 tonnes manure ha^{-1} plus annual 39.3 kg PR ha^{-1}.

PR39.3 + MAN5 by SSP8.7 + MAN5 is said to be first degree (FSD). On the other hand, net return distributions for SSP8.7 and PR39.3 cross (Fig. 2). Since the net return distribution for SSP8.7 lies more to the right of net return distribution for PR39.3, in terms of differences in area between curves cumulated from the lower values of net returns, then dominance of net return distribution for PR39.3 by net return distribution for SSP8.7 is by second degree (SSD). Through such pairwise comparisons of the tested soil amendment options, the only

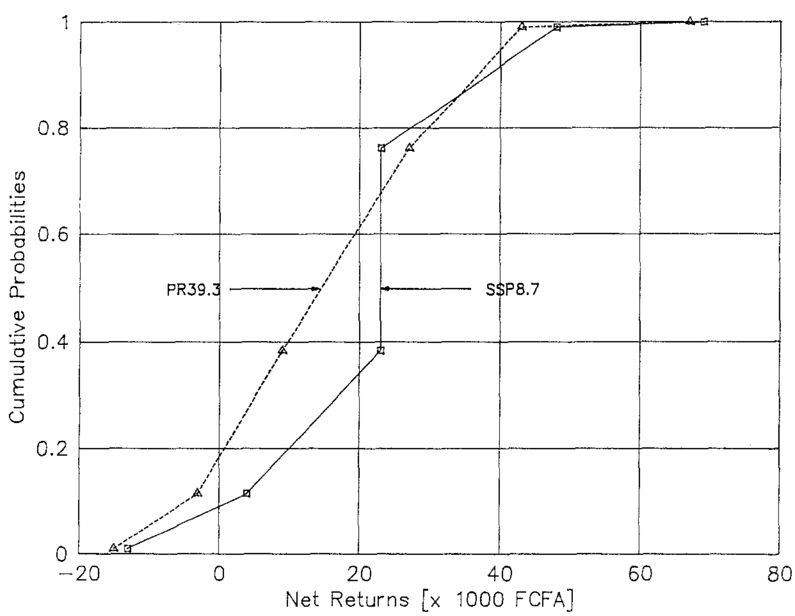

Fig. 2. Second-degree stochastic dominance of annual application of 8.7 P ha^{-1} from SSP over annual application of 39.3 kg PR ha^{-1}.

treatments that are not dominated by any other option are: the control, annual application of 8.7 kg P ha^{-1} from SSP; annual application of 17.5 kg P ha^{-1} from SSP; and a combination of annual application of 8.7 kg P ha^{-1} from SSP and 5 tonnes manure ha^{-1} applied every three years (Table 5). The lack of dominance discrimination between some of these four treatments is primarily due to the relative size of losses that occurred in the drought year of 1984. Yet, the rainfall probabilities in Table 2 show that the occurrence of a disastrous drought, similar to the one that occurred in 1984, is negligibly low and therefore 1984 data could be ignored to permit partial FSD comparisons [1].

Partial FSD comparisons show that the only soil amendment treatments that remain efficient are: annual application of 17.5 kg P ha^{-1} from SSP; and a combination of annual application of 8.7 kg P ha^{-1} from SSP and 5 tonnes manure ha^{-1} applied once every three years. Both efficient soil amendments dominate the control and the annual application of 8.7 kg P ha^{-1} from SSP, but do not dominate each other (Table 6). Therefore, at the relative unit costs of organic and inorganic fertilizers used in the analysis, it will be equally efficient to apply either 17.5 kg P ha^{-1} annually from SSP or combine annual application of 8.7 kg P ha^{-1} with 5 tonnes manure ha^{-1} every three years. However, where manure have to be collected from village compounds and spread out on fields, labor and means of transportation could be important handicaps to some farmers. This is because labor requirements for generating and transporting large quantities of organic fertilizers can restrict unit cost reductions unless transportation bottlenecks are resolved [8]. Such problems are less acute if manure was obtained from animals stabled on farms, as predominantly practised in Niger.

Table 6. Partial first-degree stochastic dominance (P-FSD) comparisons of net returns of FSD and SSD efficient treatments

FSD and SSD efficient treatments (#)	Treatment # (a)	(b)	(c)
Control (a)			
SSP8.7 (b)	–		
SSP17.5 (c)	PF >	PF >	
SSP8.7 + Man5 (d)	PF >	PF >	–

Notes: "–" denotes no partial first-degree stochastic dominance.
"PF > " denotes partial first-degree stochastic dominance of column treatment by row treatment.

The stochastic efficiency comparisons of the soil amendment options show, therefore, that if a farmer has no access to manure then the utility-maximizing strategy will be to apply 17.5 kg P ha^{-1} in the form of SSP. However, if a farmer can apply at least 5 tonnes manure ha^{-1} every three years, the utility-maximizing strategy

Table 5. Stochastic dominance comparisons of empirical distribution of net returns from 1984 to 1989

Treatment (#)	Treatment #s #1	#2	#3	#4	#5	#6	#7	#8	#9
Control (#1)									
PR39.3 (#2)	–								
SSP8.7 (#3)	–	S >							
SSP17.5 (#4)	–	–	–						
SSP8.7 + Man5 (#5)	–	–	–	–					
PR39.3 + Man5 (#6)	–	–	–	< S	< F				
PAPR8.7 + Man5 (#7)	–	–	–	< S	–	–			
Man5 (#8)	–	–	< S	< S	–	–	–		
SSP17.5 + Man20 (#9)	–	–	–	< S	< S	< S	< S	–	
Man20 (#10)	–	–	–	–	< S	–	–	–	S >

Notes: "S > " denotes second-degree stochastic dominance of row treatments over corresponding column treatments.
" < S" denotes second-degree stochastic dominance of column treatments over corresponding row treatments.
" < F" denotes first-degree stochastic dominance of column treatment over row treatment.
"F > " denotes first-degree stochastic dominance of row treatment over column treatment.
"–" denotes no dominance or inconclusiveness.

will be to combine 5 tonnes manure ha^{-1} applied once every three years with annual application of 8.7 kg P ha^{-1} using SSP.

Conclusions

The literature shows constraints posed, to agricultural production in the Sahel, by the low fertility and organic matter content of the predominantly sandy soils. An on-station experiment was conducted, at Sadore near Niamey in Niger, to evaluate some sole or combined applications of manure and P from SSP, PR and PAPR sources. This paper analyzed net return distributions and subjective probabilities associated with the soil amendment options tested, within a stochastic dominance framework.

Stochastic dominance comparisons of the soil amendment options showed that, at the relative input costs used in analysis and in the presence of annual application of 30 kg N ha^{-1} and 30 kg K ha^{-1}, it will be efficient to apply either a combination of annual 8.7 kg P ha^{-1} from SSP and 5 tonnes manure ha^{-1} every three years or only annual application of 17.5 kg P ha^{-1} from SSP. Choice of option by a farmer is dependent on the availability of adequate manure, relative input costs, opportunity cost of funds, deficiencies in the sandy soils, and labor and manure transportation constraints. In view of the necessity to complement inorganic fertilizer applications with periodic application of organic matter and the meagre resource endowments of Sahelian farmers, annual applications of 8.7 kg P ha^{-1} in the form of SSP, 30 kg N ha^{-1}, 30 kg K ha^{-1} plus 5 tonnes manure ha^{-1} every three years seems to be an appropriate soil amendment option.

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Notes

Unit cost of SSP was 45 FCFA kg^{-1} in 1984 and 50 FCFA kg^{-1} from 1985 to 1989. These prices were used to compute the cost kg^{-1} of P from SSP. Unit costs of P from PAPR and PR were assumed to be 80% and 30% of the cost kg^{-1} of P from SSP. Unit costs of urea were 60 FCFA kg^{-1} in 1984 and 65 FCFA kg^{-1} from 1985 to 1989. Unit cost of KCl was 70 FCFA kg^{-1}. Unit prices for SSP, urea and KCl were obtained from "Centrale d'Approvisionnement" of Niger.

The most frequent mode of manure transactions in Niger involve obtaining manure through overnight stabling of animals on farmer's field in exchange for millet grains for the herder and/or water for animals. This type of informal transaction does not require either the transport of manure to farm site nor labor for spreading heaped manure. Surveys of this type of farm-level informal manure transactions showed that modal cost of cattle manure is 4000 FCFA $tonne^{-1}$. 50 FCFA = 1 FF (French franc).