OIL CROPS: BRASSICA SUBNETWORK

PROCEEDINGS OF THE THIRD WORKSHOP, QUALITY TRAINING, AND CHINESE PROJECT REPORTS, HELD IN SHANGHAI, PEOPLE'S REPUBLIC OF CHINA, 21–24 APRIL 1990

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Oil Crops: Brassica Subnetwork

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PROGRESS IN RAPESEED-MUSTARD RESEARCH IN BHUTAN

Tayan Raj Gurung

The domestic production of edible oil in Bhutan is low compared to the requirement and hence, the deficit is met by imports, Table 1. The national requirement of oil is increasing every year with the growth of population and enhanced per capita demand with the increase in family income. To curtail foreign exchange expenditure on edible oil, the Royal Government has accorded high priority to the development of oilcrops in the country.

Table 1. Present food situation in Bhutan.

Item	Production (MT)	Import (MT)
Rice	43,200	25,000
Wheat	13,000	7,564
Oil	1,041	2,740

The importance and high value of oilseed was realized by the Royal Government since the introduction of "Development Plans" almost 28 years ago. With the assistance from different projects/agencies, the Department of Agriculture made numerous efforts to popularize different oilcrops in the country. For instance, in Bumthang, sunflower was introduced as an oilcrop in 1974, pearl lupine in 1977 and *Brassica napus*, mustard and soybean in early 1970's. Most of these crops could not be sustained due to various field problems, such as: pest and disease incidence, soil fertility or high nitrogen fertilizer requirement, needs for special equipment for oil extraction and small and marginal farmers. However, rapeseed-mustard continued to be the predominant oilcrop in Bhutan.

Production

Rapeseed (*B. campestris* var. toria) is the principal species grown in Bhutan. It is cultivated from 200 to 3000m elevation in approximately 5000 ha every year, both as irrigated and rainfed crop after rice and maize (1984 survey). It has higher potential in respect of area expansion and productivity. The existing area and potential area is depicted in Figure 1.

It is estimated that the national average seed yield is 700 kg/ha which is low mainly due to the poor technologies in use. Therefore, a major emphasis is being placed on finding appropriate production technologies for higher yields. The potential of improved variety has been demonstrated in Wangdi-Punakha Valley, Table 2.

Table 2. Yield comparison of improved (T9) and Local (Toria) in Wangdi-Punakha Valley.

Variety	Yield (mt/ha) 1986-87	1987-88	1988-89	Mean
T9	1.22	1.20	1.10	1.17
Local	0.76	0.67	0.54	0.66

PROSPECTIVE

Rapeseed production can be increased provided the essential inputs and technologies, including all the operations from seed bed preparation to final disposal of the produce are made available to the farmers.

Center for Agricultural Research and Development (CARD) has established several definite objectives to achieve self-sufficiency in edible oil. The following approaches clearly indicate the future prospective of rapeseed-mustard as an important oilseed crop:

1. Varietal improvement

Varietal improvement is geared towards the identification of high yielding/ early maturing varieties with reasonable resistance to major diseases and insect pests. Collections from national and international sources were evaluated in Preliminary Observation Nursery. Several lines with desirable characters have been identified and are being included in the present testing program, Table 3.

With few years of intensive testing, two high yielding varieties, T9 and M27 of Indian origin, were released in 1988

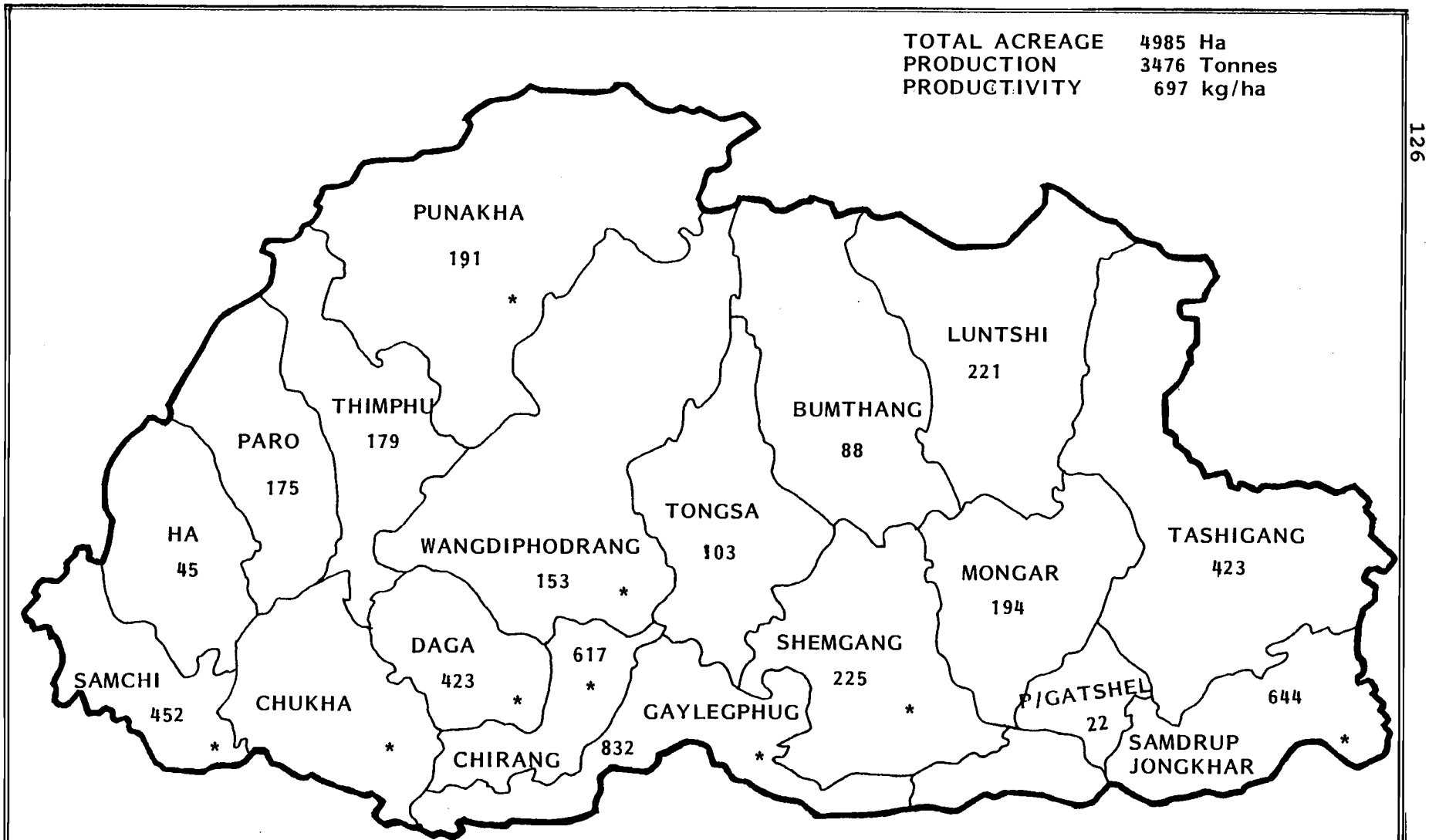

Fig. 1. BHUTAN Rapeseed Acreage (Ha) (1984 Survey, DOA).

* : Potential Area

Table 3. Selection from Mustard Preliminary Observation Nursery (PON) CARD, Wangdiphodrang 1988.

No.	Variety	Origin/ Source	Days to flowering	Branches		Siliquae /plant	1000 seed wt.(g)	Remarks
				Primary	Secondary			
1	BT 9	India	51	5	15	14	82.0	Ap.M
2.	Pusa Kalyani	"	65	4	13	179	2.0	Ap.M-S
3.	Varuna	"	77	4	12	147	4.0	Ap.M;WR.L
4.	Krishna	"	72	3	9	179	3.0	Ap.M; WR.L
5.	PT 303	"	50	3	74	3	.0	Ap.L
6.	Kranti	"	75	4	13	74	4.0	Ap.M; WR.L
7.	Toriya A	Pakistan	52	3	15	182	2.0	Ap.M-S
8.	DR 7	"	49	3	6	45	2.0	Ap.M-S
9.	Local Sano	Nepal	47	2	8	75	3.0	Ap.M
10.	Local Thulo	"	46	2	7	91	2.0	Ap.M-S
11.	Shershog Local	Punakha/ Bhutan	44	2	9	70	2.0	Ap.M
12.	Khuru Local	"	44	2	6	52	2.0	Ap.M
13.	Baap Local	Thimphu/ Bhutan	45	3	7	57	3.0	Ap.M
14.	Memba Serbu	Mongar/ Bhutan	46	2	10	65	3.0	Ap.M-S
15.	Local	Gaylegphug/ Bhutan	43	2	6	48	3.0	Ap.M-S
16.	Pachu Local	Chukha/ Bhutan	43	3	8	62	2.0	Ap.M-S
17.	Tala Local	"	50	2	6	73	2.0	Ap.M-S
18.	Dolechin Local	"	46	2	7	63	2.0	Ap.M-S
19.	Bhalujhora Local	"	49	1	8	69	2.0	Ap.M-S
20.	Bitheykha Local	Paro/Bhutan	45	1	6	43	2.0	Ap.M-S
21.	Limshi Local	"	45	2	10	58	2.0	Ap.M-S
22.	Rashigang Local	"	45	3	12	105	2.0	Ap.M-S
23.	Tashipjee Local	"	43	3	6	56	2.0	Ap.M-S
24.	Tshigen Local	"	42	3	7	52	2.0	Ap.M-S
25.	Bargkha Local	"	42	3	6	59	2.0	Ap.M-S
26.	Dogakha Local	"	42	3	12	98	2.0	Ap.M-S
27.	Lemokha Local	"	44	3	8	69	2.0	Ap.M-S
28.	Tshongkha Local	"	44	3	8	76	2.0	Ap.M-S
29.	Type 9 (Std. Check)	India	47	4	9	90	2.0	Ap.M-S
30.	Bajo Local (Check)	Bhutan	46	3	8	66	3.0	Ap.M-S

Note: Seeding date : 24.10.88, Fertilization : 80:40:20 NPK Kg/ha.

for cultivation. The improved varieties have higher yield potential than the local varieties, Table 4.

Further, the selected rapeseed-mustard varieties received through SAARC-MLTR were evaluated in Advanced Evaluation Trial, Table 5. The selected entries from 1989-90 trials will be advanced to on-farm testing.

Table 4. Yield comparison (t/ha) of improved and local rapeseed/mustard varieties, 1988.

Sites	VARIETIES			
	T9	M27	Varuna	Local
Wangdi-Punakha	1.1(124)*	1.0(125)	1.3(140)	0.9(125)
Chirang	0.7(137)	0.5(137)	1.0(178)	0.6(137)
Tashigang	0.3(113)	0.5(113)	0.5(154)	0.4(107)
Gaylegphug	0.2(124)	0.4(125)	0.2(140)	0.4(125)

*Numbers in parenthesis are maturity days.

Table 5. Selection from Initial Evaluation Trial, CARD, 1988.

Variety	Days to Flowering	Days to Maturity	Branches Primary	Branches Secondary	Siliquae per branch	1000-Seed Wt.(g)	Mean Yield (t/ha)
Krishna	98	149	3	6	10	4.0	1.04
Pusa Bold	93	155	3	4	6	4.0	1.03
Vaibhav	94	145	3	6	8	4.0	1.02
PT303	94	136	3	7	8	3.3	1.01
Toria 7	93	136	3	6	7	3.0	1.00
TS27	91	133	3	6	9	3.3	1.00
CHLS	94	136	3	5	8	3.6	0.98
PT30	93	135	3	6	7	3.0	0.95
M27	96	130	4	6	9	2.7	1.00
T9	93	135	3	6	9	3.0	1.00
Local (Check)	92	120	3	6	7	2.7	0.96

Note: Sown: 16.11.88 Fertilizer: 80:40:20: NPK kg/ha

2. Agronomy

Current cropping systems demand growing rapeseed in sequence with major crops like rice and maize. This brings the question of possibility of early sowing and timely harvesting of rapeseed.

Research has confirmed that October-mid November sowing in rice-based cropping system and September-October in maize-based cropping system are necessary for higher seed and oil yields, Tables 6 and 7. Later sowings were wiped out by polyphagous caterpillar and aphids.

As per the available information, the recommended rate of fertilizer is 75:50:0 NPK kg/ha. In a separate trial, the highest yield was reported from application of 80:40:30 NPK kg/ha, Table 8. As this crop follows the major cereal crops, studies on integrated use of plant nutrients was felt necessary.

Such studies have been initiated from the last crop season with an objective of formulating a sustainable nutrient management system for a cropping pattern rather than a crop-wise recommendation.

Table 6. Yield response (t/ha) and growth duration (days) of popular rapeseed varieties at different sowing dates.

Sowing Dates (S)	V A R I E T I E S (V)@ T9	M27	Varuna	Local	Mean yield
Sept.30	1.01(126)*	1.16(134)	1.48(138)	1.01(134)	1.17
Oct. 30	1.21(120)	1.12(120)	1.34(138)	1.18(120)	1.21
Nov. 15	1.13(124)	0.99(120)	1.32(140)	1.12(120)	1.14
Nov. 30	0.84(125)	0.73(125)	0.92(145)	0.63(125)	0.78
Mean	1.05	1.00	1.27	0.99	

Statistical analysis	Significance	C.V.	LSD (0.05)
Sowing date (S)	*	6.09	0.104
varieties (V)	**	8.28	0.093
S x V	**		

@ Numbers in parenthesis are maturity in days.

Table 7. Yield (t/ha) and growth duration of varieties at different sowing dates at observational plot, CARD-Bhur.

Sowing Dates	V A R I E T I E S* T9	M27	Local	MEAN YIELD
Sept 30	0.16 (93)	0.35 (97)	0.34 (95)	0.28
Oct 15	0.24 (90)	0.40 (98)	0.38 (94)	0.34
Mean	0.20	0.38	0.36	0.31

* Number in parenthesis are maturity days.

3. Technology Transfer

The major step towards promotion of rapeseed-mustard cultivation was "Mustard Intensification Program, 1988-89" with the objective of acquainting the farmers with the improved package and thereby achieving self-sufficiency in edible oil. Under this program, 88.2 ha (764 households) was planted to T9 by Punakha-Wangdi Valley Development Project. The improved package gave a substantial yield increase over the local package, Table 9.

Table 8. Rice-based fertilizer trial on mustard, Chirang, 1988.

Rates (kg/ha) N P K	FYM	Yield (t/ha)
0: 0: 0	-	0.432
0:40:30	-	0.448
40:40:30	-	0.454
80:40:30	-	0.754
40: 0:30	-	0.341
40:80:30	-	0.631
40:40: 0	-	0.545
40:40:60	-	0.567
0: 0: 0	5000	0.370
0: 0: 0	10000	0.406
	CV% :	16.9
	LSD(0.05) :	0.143

Table 9. Mustard intensification program 1988-89, PWVDP.

Gewog/Block	Average Yield (t/ha) T9	Local
Chubbu	1.923	0.453
Talow	0.708	0.370
Ghuma	1.883	0.910
Tewang	0.558	0.743
Kabji	0.320	0.270
Shengana	1.215	0.490
Bjimi	1.315	0.570
Mean	1.132	0.544

FUTURE DIRECTION

Present experience indicates that it is necessary to solve the field problems which are varied and often complex with proper strategy. Accordingly, the fields which need future attention are as follow:

1. Varietal improvement;
2. Diversification of oilcrops;
3. management of nutrient and pest
4. Production of quality seed;
5. Field demonstration;
6. Training of field-level extension staff and farmers;
7. Possibility of area expansion;
8. Post harvest/processing; and
9. Marketing.

DISCUSSION

Kumar: What percentage of the total crop area in Bhutan is for oilseed production?

Gurung: 9% of the total area of the country is agricultural land. Of these 50,000 hectares are sown to rapeseed; rapeseed is 90% of the total oil crops. The altitude of the cropping areas in Bhutan ranges from 200 - 3000 m all *Brassica campestris.*

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