CURRENT STATUS OF RESOURCE ALLOCATION FOR HORTICULTURAL RESEARCH UNDER NEPAL AGRICULTURAL RESEARCH COUNCIL

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BACKGROUND

Horticulture, a mixture of science, technology and art covers improvement, production, postharvest management and marketing of fruits, plantation crops, vegetables, spices, flowers and medicinal and aromatic plants. In Nepal, more than 200 species of horticultural commodities are believed to be cultivated in one or other ways including about 40 species of fruits and plantation crops, 50 species of vegetables, 100 species of ornamental plants and 25 species of spices. Out of them, nearly 100 species are grown commercially. Most of the medicinal and aromatic plants are still collected from wild and treated as non-timber forest products. Government statistics shows that horticultural crops contributed about 33.5% (potato 6.5%, vegetables 13.54%, fruits, plantations and spices 13.48%) to AGDP in 2012/13 (MoAD, 2013). If flowers and medicinal plants are included on it, the sectoral contribution may reach to 35 percent.

Horticulture sector primarily vegetable farming has been proven as a boon for resource poor and even landless people. Moreover, educated people, younger generation and foreign employee returnees are highly attracted to horticulture enterprises and have been investing on it. Resource rich people are gradually started to invest on horticulture sector like fruit and plantation crop production and processing industries. Its repercussion is being visible in a steady fashion on import substitution and export promotion. The present scenario of production, demand, trade (import/export) and potential of the country demonstrate the wide scope of expansion of the sector in future. Serious thoughts and commitments are pivotal for the exploration of its potential. To be in competitive in the global markets in the context of WTO critical inputs like appropriate technological advances and market services are the most needed interventions. Nepal Agricultural Research Council (NARC) is the public sector institution which is dedicated for the technological advancement of agriculture including horticulture in the country. This paper critically analyses the investment pattern on horticulture sector under NARC system and suggested way forward for technological outputs.

IMPORTANCE OF THE SECTOR

High income generating: Horticulture is a high income generating enterprise. For example potatoes and vegetables are 9 and 24 times more profitable respectively than maize. Studies have shown that mango cultivation gives about 5 times, mandarin 24 times and banana 36 times higher income than cereals (Thapa, 2009). Because of better economic return attraction of youth and educated people and business houses towards horticulture enterprises is rapidly increasing in Nepal. Majority of the commodities identified by One Village One Product (OVOP) programs are horticultural crops.

Value addition opportunity: Government statistics shows that Nepal imported processed horticultural products (except wine) worth of about NRs 1 billion in 2009/2010 (MoAC, 2010). Of the total import value, potato chips alone worth nearly Rs 233 million and more than 40 types of other processed fruit and vegetable products worth of Rs 700 million were also imported in Nepal during the same fiscal year. The processed/preserved horticultural products that have been imported in Nepal are in significant quantities, which include potatoes (chips, French fries, preserved, frozen), tomatoes, beans, jam, jellies, preserved fruit and juice. Such products can be produced easily within the country for domestic markets through public private partnership approach which will create additional employment and income through value addition and helps reducing the trade deficit of the nation.

Export potential: As a member of WTO Nepal has opportunity to export its niche and specialized branded products in international markets. Export possibility with horticultural commodities especially the organic product is comparatively high than that of other crops. Lentil is the only non horticultural commodity exported from Nepal in significant quantity. Large cardamom, ginger, tea, rainy season vegetables, cinnamon and herbs are major horticultural products exported to different countries. Organic coffee is also coming up as an exportable commodity since last decades. The number of commodities and their quantities being exported at present are far less than our potential. We can diversify commodities, increase quantity and quality for export and expand the export market destinations with special branding of our niche commodities. However, technological advancement and upgrading strategies at all level of commodity value chain is very critical to become competitive in global markets and to expand export.

Table 1. Import and export situation of selected commodities (2009/2010)

S.N	Commodities	Import Value (Rs)	Export Value (Rs)	Import export ratio
1	Potatoes fresh , chilled and chips	1,257,818,916	0	All import
2	Onions, shallots & leeks	726,470,976	5,207,567	139.50
3	Garlic	232,962,426	0	All import
4	Dried vegetables & beans	1,163,481,534	9,504,760	122.41
5	Citrus fruits	72,526,671	484,221	149.78
6	Apple	699,492,861	2,926,068	239.06
7	Pepper: fresh and grounded	351,380,584	551,513	637.12
8	Seeds of coriander	112,029,017	0	All import
9	Cumin seeds	292,472,958	3,051,053	95.86
10	Turmeric	15,097,763	9,173,146	1.65
11	Flower & Vegetable Seeds	141,263,365	2,731,419	51.72
	Total	5064977071	33629747	150.61

Import substitution: Despite being an agricultural country having high potential for horticultural crops current gap between total demand and supply from domestic production is very high. According to government statistics in 2009/10 Nepal imported horticulture commodities worth of Rs 17.38 billion and exported about half of this value (Rs 9.35 billion). Import and export data of horticultural commodities presented in Table 1 gives the clear picture that we are importing many commodities that can be easily produced in the country. Such commodities include potato, dried vegetables and beans, onion, garlic, fresh vegetables, vegetable seeds, chilli, coriander, cumin, fenugreek, turmeric and most of the fruits. Supply of fruits and vegetables in Kathmandu valley is highly dependent on import (Table 2). All these statistics elucidates that there is huge scope to expand production scale of horticultural commodities targeting to import substitution.

Table 2. Supply situation of fresh fruits and vegetables (kg) from domestic production and import at Kalimati Wholesale Markey in 2067

Commodity	Arrival from Import		Total Arrival (kg)	Import (kg)	Import %
	India	China			
Tomato Big	2453400		4029000	2453400	60.9
Potato White	5051000		8409000	5051000	60.1
Onion Dry	15733000	1626000	17435150	17359000	99.6
Apple	180000	921575	1102075	1101575	100.0
Banana	271870		282070	271870	96.4
Lime	1740100		1753100	1740100	99.3
Pomegranate	89920		92020	89920	97.7
Grapes	120674		120694	120674	100.0
Water Melon	3965390		3965390	3965390	100.0
Sweet Orange	242040		354990	242040	68.2
Pine Apple	115195		120485	115195	95.6
Pear	3710	42975	58475	46685	79.8
Guava	171050		184560	171050	92.7
Musk Melon	300		300	300	100.0
Kinnow	1400		1400	1400	100.0
Chilli Dry	82200		87200	82200	94.3
Chilli Green	2715000		4002650	2715000	67.8
Capsicum	349000		556000	349000	62.8
Garlic Dry Chinese		1790000	1791000	1790000	99.9

Source: www.kalimatimarket.com.np, Kalimati Fruits and Vegetables Market Development Boards

Employment generation: Statistics shows that there is 11.4 m labor force available in Nepal, and is growing at the rate of 2.6 percent per annum (NPC, 2007). That means it roughly adds about 300 thousand employment seekers to the labor market annually. The comparative statistics from various empirical studies revealed that

there are higher numbers of laborers used per unit area in horticultural crops as compared to traditional cereal crops. Horticulture creates employment not only in production but also in transportation, storage, whole selling, retailing and processing. These value chain processes simultaneously develop other allied industries like bottle factories, packaging materials and cold storage. People involved in horticulture enterprises feel proud on the profession not privation like in general agriculture. Thus youth and educated people are attracted to invest on horticultural enterprises. It has special significance in the context of lesser interest of youth on agriculture.

HORTICULTURAL RESEARCH POLICY

Horticultural research and development is primarily guided by the development projects implemented by the government. Releasing the need of a concrete plan, government decided to have a Horticulture Master Plan in mid-Eighties and final draft was in existence in early-Ninety. Unfortunately the document never been endorsed by the government and now become a part of the history. APP has identified technologies (research) as one of the four priority inputs and few horticultural commodities (off-season vegetables, vegetable seeds, citrus, apple and large cardamom) as priority outputs. Despite focused by APP, outputs are not evident even on prioritized commodities. Under broader umbrella of APP, government has also released/promulgated, National Agricultural Policy 2004, Agribusiness Promotion Policy 2006 and Agro-biodiversity Policy 2007 (MOAC, 2008). Agriculture Development Strategy (ADS) which is under preparation is much clear about horticultural research. It has clearly mentioned that horticultural research should be executed in institutional model upon establishing National Horticultural Research Institute under auspicious of NARC.

Nepal Agricultural Research Council has full authority as per the NARC Act 2048 to develop National Agriculture Research Policy. NARC Vision (2011-2030), developed in 2010 (not yet endorsed by the government), has provided a broad guideline for overall agricultural research but it does not has clear plan for sectoral research. Therefore, agricultural researches (including horticulture) being undertaken by public sector (NARC and NARDF) are mainly based on very broad guidelines envisaged by APP, National Agricultural Policy 2004 and periodic plans (Tenth Five Year Plan, and Three Years Interim Plans). Since government does not have clear national research strategy and policy, various institutions including private are operating in their own way. It is not even publicly known the complete inventory of research projects and the actors involved on horticultural research including NGOs. It has resulted lesser concentrated efforts, potential duplication, scattered resources and technologies generation in piece meal.

HORTICULTURAL RESEARCH SETUP

National Agriculture Research and Service Centre (NARSC) was in existence under Ministry of Agriculture just before the establishment of NARC as an autonomous body. All 25 agriculture stations exclusively involved on technology generation and services of horticultural crops were under NARSC. Upon the establishment of NARC, only 5 of such stations were made available for horticultural research in the field level. The stations are not sufficient to accommodate high number horticultural commodities and to represent diverse agro-climatic conditions of the country. National Vegetable Research Program envisaged by APP to be established at Khumaltar has not yet come to reality. In the NARC management itself, single director is planned for crops and horticulture. Paradoxically, separate fruit and vegetable divisions were in existence for horticulture when it was under NARSC and later upgraded to Directorates under Department of Agriculture.

Horticulture Research Division (HRD), the only dedicated entities for horticulture in the central level in NARC, came into existence in 1994, only after four year of NARC establishment. Hence, it can be said that institutional set up was not appropriately planned for horticultural research during the period of NARC establishment. Not only planning, NARC has failed to give momentum for horticultural research what so ever was planned. It has created big vacuum and its repercussions is one of generic problem for horticultural research under NARC. Even after the establishment of HRD, it has been running in bare minimum physical and human resources. It has neither sufficient resource to carryout research itself nor has authority to mobilize other stations. This has led to crisis in unified technical leadership. Faulty organizational set up along with poor technical leadership has made the research projects heading everywhere without having clear destination. Upon realizing the fact, efforts are initiated to have consolidated planning and program. When planning was done to cover major agro-ecological zones, it was found that current research networks within the country are insufficient to make the national recommendations. For example NARC does not have a single farm in central and eastern region to represent the hill hills agro-ecological condition.

RESEARCH LINKAGE

In international arena, three international organizations (two under CGIAR and one international centre) working in vegetable crops. International Potato Centre (CIP) is working on potato and sweet potato and has very good linkage with National Potato Research Program. AVRDC-The World Vegetable Centre is the main international institution for vegetable crops. In the past, AVRDC and NARC collaboration was limited on few time bound projects despite having more than 30 years of AVRDC's existence. In 2013, NARC made a new MoU and both organizations are working more closely since then. Being an international centre, AVRDC has limited program and limited crops to deal with. NARC is also in the loop of international research carried out by International Centre for Agricultural Research for Dry Areas (ICARDA) particularly for leguminous vegetables like cowpea and broad bean.

Vegetable is an important, but only one component of horticulture. No public sector institutions at international level exist for other component of horticulture like fruits, spices, herbs, aromatic plants and flowers. This clearly indicates that development fate of these commodities will rest with national research system. Since, technologies are fuel for development on these commodities and have to be started from the scratch; more investment is needed for research infrastructures and human resources. Unfortunately, it has not been realized so far.

RESEARCH PLANNING PROCESS

Nepal Agricultural Research council has an established research planning process. In the process, individual researcher prepare research project based on the broad directives provided by NARC headquarters (Figure 1). The research proposal endorsed by the head of the field office is reviewed by technical panel composed of experts from different areas. The commented proposal is sent back to the researcher for improvements before it gets approved.

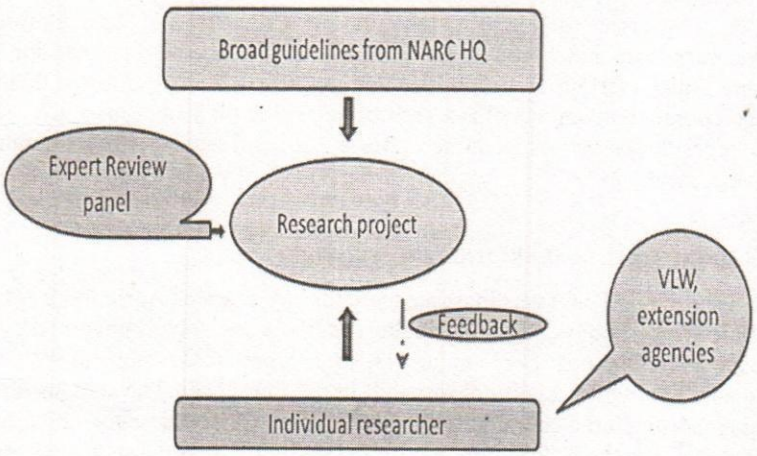

Figure 1. Research planning process of NARC

The planning approach can be said as hybrid approach since research proposal is prepared by filed level researchers based on directives from the top level. The system seems to be pragmatic and efficient. However, it is realized that the research outputs are not very prominent in field level. This could be due to very general type of directives provided by the headquarters. Since the directives are of abstract type, individual researcher can understand by his/her own way and propose the research project limiting with his/her knowledge and experiences. This has led to discrete information and research in the piecemeal.

MAJOR ACHIEVEMENTS

With limited infrastructure and human resources, horticulture research has given proven technologies to the Nepali farmers. A total of 49 (48 open pollinated +1 hybrid) varieties of vegetable crops are already released /registered and many are on the queue. Plastic house technology is well established and adoption is every increasing. TPS technology becomes a boon for clean planting materials and for higher tuber yield. Year round production technologies for my vegetable crops like tomato, cauliflower, cabbage, carrot, radish, bean, and chili. Brinjal etc. by exploiting climatic variations and variety have contributed lot for import substitution and export promotion in some extent. Efficient and effective plant protection measures by organic and inorganic means were become popular for major pests like club root, root knot nematode, chili rot and late blight of potato. For commercial agriculture, coffee pulper is very popular among the coffee growers. In case of fruits, production season expansion technology is available by using appropriate varieties and altering growing zones. Spur type apple varieties are selected but still needs few year for rectify the information. Micro-propagation protocols and disease free saplings production through micro-propagation is established for potato and large cardamon. In addition to research outputs, the horticultural research stations have been supplying source seed of potato and vegetables for further seed multiplication.

ANALYSIS OF CURRENT PROJECTS

Horticulture, crop, livestock and fishery are main component of agricultural research carried out by NARC. In addition to the discipline, NARC budget summary head also include cross-cutting approach like outreach. This has made difficulties to calculate exact budget allocated for the horticultural research. However, we have tried to include all possible information and research expenditure on horticultural crops. This is high time to look critically on the investment made on horticultural research. Since technological demands of horticultural crops are coming very aggressively, research investment has to be made as per the technological demand of the clients. In addition to the client demand, research should also be vigilant to address the need of current national policies, international treaties and considering the new frontiers.

It is obvious that output is primarily depends on the inputs. Hence monitory input investment during last six year (2063/64 – 2068/69) is examined to understand the horticultural research situation in NARC. Six year budget allocation for horticultural research shows that about 12 to 15.5% budget was given to horticulture (Table 3).

Table 3. Total budget allocated for horticultural research projects during FY 2063/64-2068/69

Fiscal year	NARC budget ('000)	Horticulture budget ('000)	Share (%)
2063/64	111272	13487	12.12
2064/65	133507	17302	12.96
2065/66	131209	19165	14.61
2066/67	122500	17413	14.21
2067/68	350000	47039	13.44
2068/69	370000	57065	15.42

The allocated budget seems to be very low while comparing with the contribution made by horticulture to AGDP. Considering the contribution to AGDP and number of commodities, budget for horticulture research should be increased to 25% at this point of time. The limited budget allocated for horticulture is not evenly distributed to the sub-sectors. Figure 2 illustrates that about a half proportion of the budget is absorbed by vegetable itself, which was followed by fruit. Ironically, very negligible research investment is made for floriculture. This is how the private sector is far ahead than public sector in the case of floriculture. It is worth to mention, NARC has not yet started its research on aromatic and meditational plants despite demands from entrepreneurs.

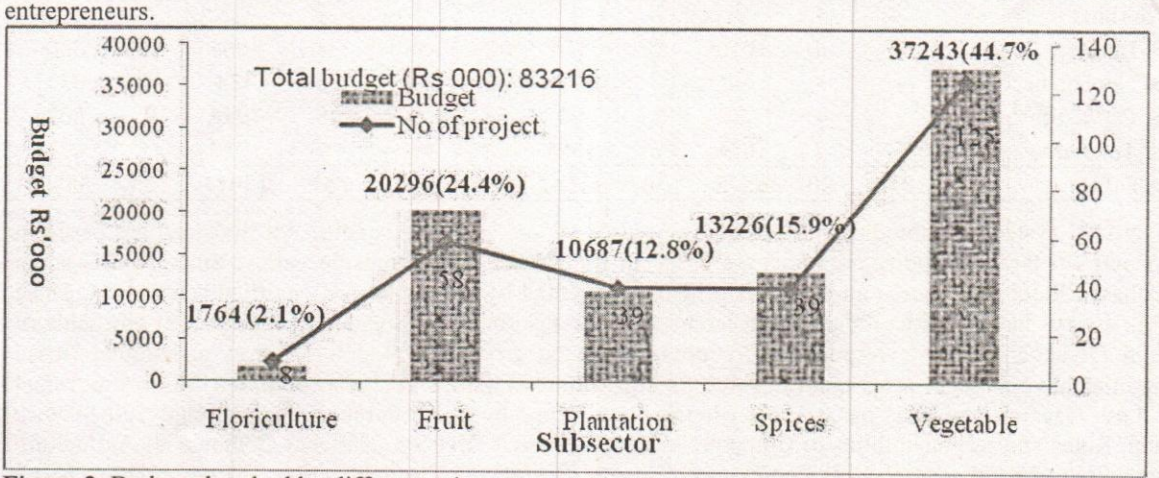

Figure 2. Budget absorbed by different sub-sectors and implemented projects

While analyzing the budget absorption by different discipline, about 40% budget is expended for breeding activities. It is noteworthy that NARC is not developing varieties in line with the investment on the discipline. Figure 3 shows that execution of research is very low for postharvest and socioeconomic research. Furthermore, research on plant protection is also not sufficient to cater the need of commercial growers.

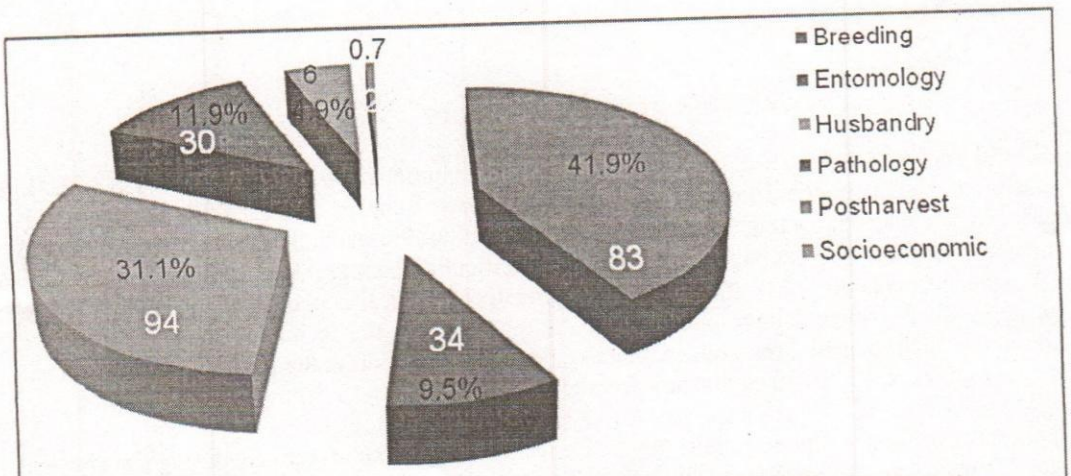

Figure 3. Number of projects and budget share (%) captured by different disciplines

Excluding the budget expenditure in Kathmandu, a bigger chunk of money is invested for mid hills. Money expended by ARS, Pakhribas alone is higher than that of total expenditure made by all research stations based in terai (Table 4). Since NARC has only one farm dedicated for horticulture in high hills, resource allocation for high hills is very minimum.

Table 4. Projects implemented and budget (Rs '000) allocated to RARSs and ARSs

Station	Flower		Plantation		Fruit		Spices		Vegetable		Total	
	No	Budget	No	Budget	No	Budget	No	Budget	No	Budget	No	Budget
ARS, Pakhribas	1	265	4	1369	3	2052	8	4373	7	1147	23	9206
ARS, Belachapi	-	-	-	-	-	-	-	-	4	1442	4	1442
ARS, Dailekh	1	350	2	130	1	794	4	775	7	1430	15	3479
ARS, Doti	-	-	1	350	-	-	-	-	-	-	1	350
ARS, Malepatan	1	370	7	2640	5	956	1	35	10	1962	24	5963
ARS, Rajikot	-	-	-	-	4	2532	-	-	3	2039	7	4571
ARS, Ranighat	-	-	-	-	1	90	-	-	1	89	2	179
ARS, Surkhet	-	-	-	-	-	-	-	-	1	235	1	235
RARS, Lumle	1	55	4	1010	2	350	2	580	7	2005	16	4000
RARS, Neplaganj	-	-	-	-	7	2713	2	144	2	474	11	3331
RARS, Parwanipur	-	-	-	-	1	90	-	-	8	1938	9	2028
RARS, Tarahara	-	-	2	1076	6	1985	-	-	7	1250	15	4311
Total	**4**	**1040**	**20**	**6575**	**30**	**11562**	**17**	**5907**	**57**	**14011**	**128**	**39095**

Under NARC system, commodity and discipline based divisions are in existence. All divisions are based in Kathmandu but the commodity programs are based in Kathmandu and/or outside valley. Since NARC adopt project based funding, resource allocation is primarily governed by the number of qualified researchers. Since NPRP is always having critical mass of researchers, it has absorbed more resources than that of Horticulture Research Division, which is responsible for all horticultural crops except potato, citrus and ginger (these commodities have national programme) (Table 5). Agriculture Botany Division is confined within few cereal crops. Less research emphasis has given on horticultural crops by Biotechnology Division and Soil Science Division. Roles and responsibilities of Commercial Crop Research Division, National Commercial Agriculture Research Program and several other commodity research programs are in duplication. More importantly, all crops have commercial value and therefore, branding few commodities as commercial crops does not bear any scientific basis.

In the context of more resource investment on vegetable crops, it would be worthwhile to look on the efforts on different discipline. Breeding consumed about 50% budget and about 25% is used by husbandry (Fig 4). Less than 2% resources is invested on postharvest, seed and socioeconomic research.

Table 5. Projects implemented and budget allocated to disciplinary divisions and commodity programs

Division/Program	Flower		Plantation		Fruit		Spices		Vegetable		Total	
	No	Budget	No	Budget	No	Budget	No	Budget	No	Budget	No	Budget
Agri Botany Division			1	65							1	65
Agri Eng Division			1	247	2	205			4	1230	7	1682
Biotech Unit									1	2117	1	2117
Comm Crop Division			4	2767			1	785			5	3552
Entomology Division					1	640			6	1667	7	2307
Food Res Unit			2	527	3	502	2	400	2	252	9	1681
GRP, Kapurkot							7	4560			7	4560
Hort. Res. Division	2	454	1	140	4	1520	1	175	11	5746	19	8035
NCARP, Pakhribas							1	850	1	503	2	1353
NCRP, Paripatle					9	5676					9	5676
NPRP, Khumaltar									18	9305	18	9305
Plant Patho Division	1	270	1	156	1	50	2	549	5	1556	10	2581
SARPO Division			2	210	2	142			2	195	6	547
Soil Sc. Division									3	800	3	800
Total	**3**	**724**	**12**	**4112**	**22**	**8735**	**14**	**7319**	**53**	**23371**	**104**	**44261**

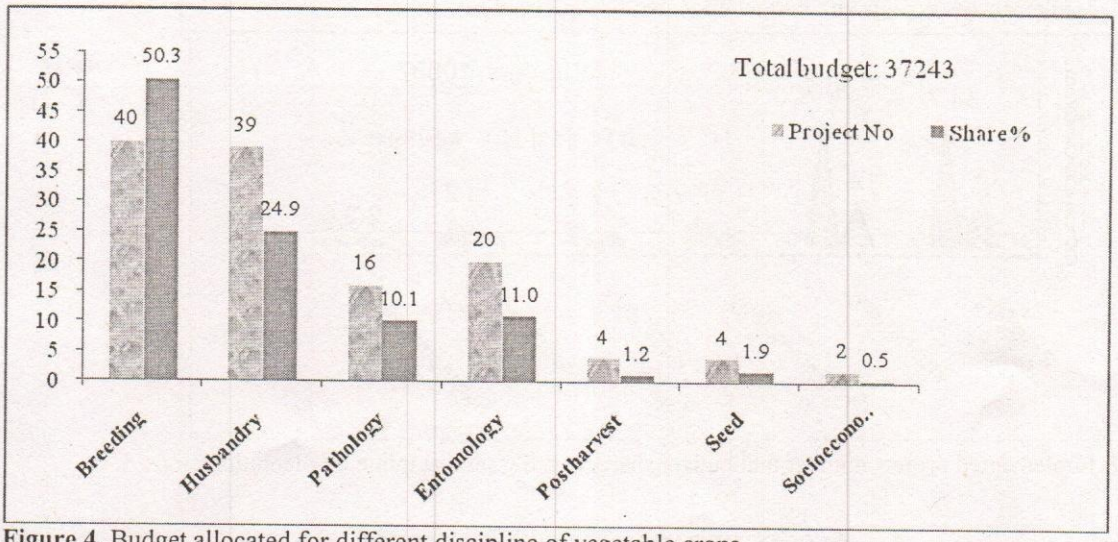

Figure 4. Budget allocated for different discipline of vegetable crops

In case of fruits more resource is invested on husbandry research and more or less the same investment on breeding. Unlike vegetables, more emphasis is evident on post-harvest of fruit crops (Fig 5). But critical evaluation of post-harvest research revealed that researches were completely on postharvest processing not on postharvest handling. Since we are still in the import substitution phase for fresh consumption, more focus has to paid on postharvest handling research.

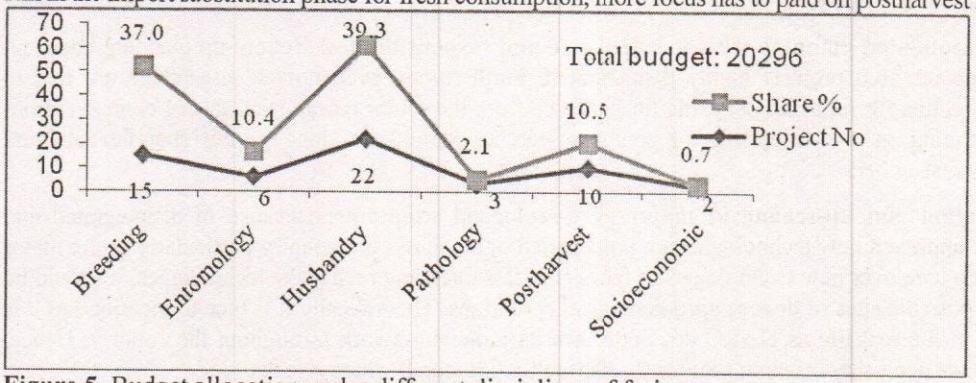

Figure 5. Budget allocation under different disciplines of fruit crops

Because of the existence of NCRP, citrus able to take 42.9% budget out of fruit crops which was followed by apple 14.9, banana 7.5% , mango 6.8, grape 4%, strawberry 3.9%, kiwifruit 2.1%, pomegranate 1.8%, pear 1.7%, walnut 1.8, macadamia nut 1.4 % and Chestnut 0.8%. Rational of investment of these crops is not very clear and technologies developed are not made available in many cases.

It is interesting to note that large cardamom has absorbed more (42.2%) resource than National Ginger Research Programme (ginger 25.9 and turmeric 14.1%). Other spice crops considered by research were onion (8%), Akabare chili (4.2%), hot chili (4.2%) and garlic (1.5%). On these crops, focuses were paid to pathological research where 35% resource is invested (Fig 6). Despite high investment, the outputs are not very much evident on disease management on spice crops. In the context of huge import volume of onion, garlic and chili resourced allocation for their technology development is very nominal.

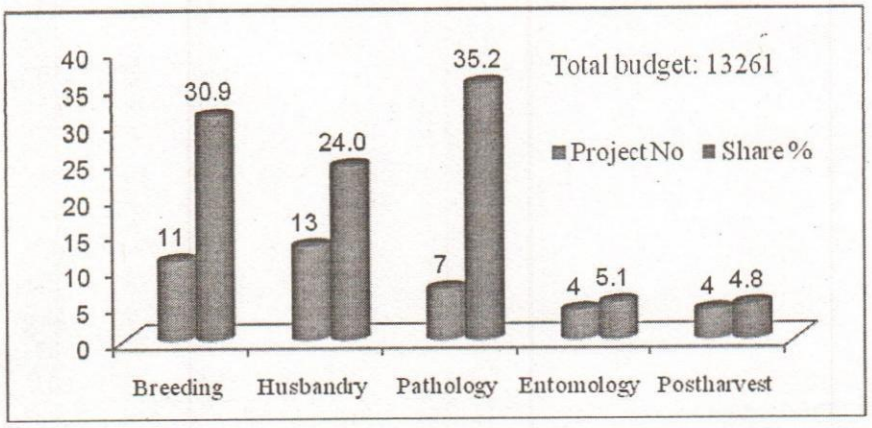

Figure 6: Implemented projects and budget allocated for Spices crops

In the last six year the research system covered tea, coffee, jatropha, olive and betel nut. Out of these crops tea (47.1%) and coffee (42%) utilized about 90% of the resources. Investment on jatropha, olive and betel nut were 4.6%, 3.3% and 2.3% respectively. In the case of plantation crops, husbandry research took the higher proportion of resources which was followed by husbandry (Fig 7)

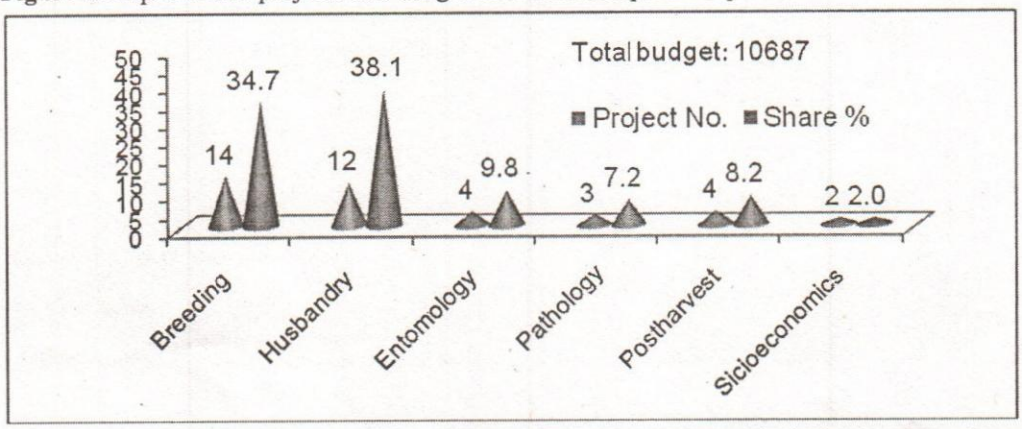

Figure 7. Implemented project number and budget share by different discipline on plantation crops

SUGGESTIONS FOR FUTURE CONSIDERATION

Analysis of budget allocation and research undertaken by NARC entities clearly indicate that we have areas for improvements to make research more vibrant and output oriented. To do so following suggestions have been made for future consideration without any delay.

Commodity based consolidated planning with specified role and responsibilities: Bottom-up planning based on abstract directives made research projects highly disintegrated. Furthermore, even novice researchers are free to develop new projects and there is no mandatory rule for guidance from the senior researchers. In that context nation-wide consolidated planning in the leadership of senior researcher should be done giving specific role and responsibilities to every researcher.

Technological verification and up-scaling in major agro-ecological situations: Because of disintegrated and individualistic research approach new technologies are not verified in all across the country particularly in the major agro-ecological zone. To handover new technologies to farmers in fast track and rectify the technologies, it should be introduced as many as possible sites of diverse agro-ecological conditions. Theoretically it is nice to mention but it is difficult to implement in the real life as NARC does not have its judicial network throughout the country. Hence, government has to provide necessary research stations for horticultural research where it lacks.

Technology registration and user friendly publication: Technology registration is not in practice in Nepal. This creates many recommendations for the same practice and which leads to confusion to farmers. Hence, there should be a provision of technology registration like variety. Upon registration, there should be a user friendly publication in Nepali language preferably with pictures and drawings.

Technology linkup with commodity organizations and industries: Despite making constant contribution to research and technologies recommendation, technology adoption rate is very slow and low. To combat the situation, there should be a formal mechanism to linkup researchers with the technology users. This could be done directly handing over the technologies to commodity organizations like coffee growers association, organic growers, tea industries etc.

Identify an institution for horticultural research coordination with authority: Agriculture Development Strategy has categorically mentioned for the establishment of horticultural research institute under NARC. For the time being or before establishing the institute, Horticulture Research Division should give full administrative and technical authority and responsibility for the coordination of horticultural research within NARC and coordination with other agencies.

Planning for physical facilities: Many horticultural commodities are of long-term nature. There should be a proper planning for physical facilities like establishment of orchards and laboratories for simple analysis and post-harvest studies.

Appropriate human resource planning and positions: Since project based funding system exist in NARC, resource allocation primarily depends on the type of human resource the institution have. That is why NARC should have proper human resource planning for different sectors of horticulture and different level of positions. To have the balanced research, every sub-sector and discipline of horticulture should be led by at least one principle scientist.

Strong technical monitoring: After coordinated planning and allocated responsibility, there should be strong monitoring and technical backstopping. This will move research process in the same pace and wavelength in different research stations.

Judicial resource allocation: Considering the importance of horticultural commodities and contribution by the sector budgetary, human and physical resources should be allocated for horticultural research in scientific ways.

REFERENCES

MoAD, 2013. Selected Indicators of Nepalese Agriculture and Population. Ministry of Agriculture Development, Singh Durbar, Kathmandu.

NARC (2007, 2008, 2009, 2010, 2011, 2012). Annual Programme and Budget. Planning Division, Nepal Agricultural Research Council, Singhdurbar plaza.

NPC, 2007. The Three years Interim Plan. National Planning Commission, Singh Durbar, Kathmandu.

Thapa, P. 2009. Employment and income generation through horticultural industries. Proceedings of the Fifth National Seminar on Horticulture, June 9-10, 2008. Kathmandu Nepal. Nepal Academy of Science and Technology, Nepal Agricultural Research Council and Nepal Horticulture Society.